

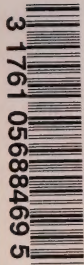
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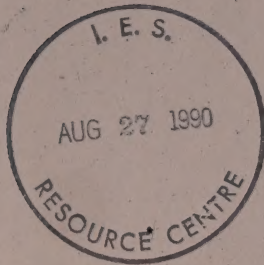
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**SUSTAINABLE DEVELOPMENT
AND LAND USE PLANNING:**

**TOWARDS PRINCIPLES AND GUIDELINES
FOR IMPLEMENTATION AT A LOCAL LEVEL**

by:
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Undertaken as a research initiative and submitted to Environment
Canada and the City of Burlington, Ontario.

Prepared on a Co-op work-term for
Water Planning and Management Branch
Inland Waters Directorate-Ontario Region
Environment Canada
Burlington, Ontario
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Note: The views and recommendations presented in this report are
those of the author, and are not necessarily endorsed by
Environment Canada.

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The concern and interest of many people, made this report possible. I would like to thank Tom Muir (Environment Canada) for his invaluable assistance, insight and strengthening contributions; Allan Ramsay (City of Burlington) for his continued support, guidance and the City of Burlington's resources; and Carol Donaldson, Anne Sudar, Gary Jones and Ray Rivers (all from Environment Canada) for their input and suggestions.

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SUMMARY

The purpose of this report is to combine both empirical and conceptual evidence to develop guidelines and principles necessary to move towards sustainability. Three eras of characteristic growth; 1930-1949, 1950-1969, and 1970-1989, are compared. Communities within the City of Burlington, which were built during these periods, are used as representations of the various land use patterns which developed. These are; the Downtown area, the Aldershot community and the Headon Forest community, respectively.

The evidence shows that many significant trends have occurred. Since the 1930's, the consumption of energy, water and other resources has vastly increased. Urban sprawl has developed enormous amounts of prime agricultural land. Although a major contribution to noise and air pollution, and the paving over of prime agricultural land, among other things, the automobile is still a major focus in our society. The lot sizes of single-family dwellings in the new communities have decreased, even though the size of the houses have increased. As development in this unsustainable manner continues, the average costs and marginal costs associated, are dramatically rising and our environment is being further deteriorated.

It is clear that alternatives must be implemented. More efficient resource use, as well as a reduction in the demand, are necessary. Agricultural land, and the ability to feed ourselves are important aspects of sustainability which need to be preserved. Community design should discourage the use of the automobile, move towards clustered housing with medium densities, integrate home and work and allow for substantially more open, natural areas.

The consumptive and exploitive values in the industrialized world are reflected in the present land use patterns. Integration of environment and economics is essential. Actions towards sustainability must begin immediately.

1. INTRODUCTION

1.1 The Issue of Sustainable Development

The Brundtland Report, published as Our Common Future in 1987, is credited with coining the phrase 'sustainable development'. Gro Harlem Brundtland defines it as development which is able to "meet the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, 7). The actual definition of 'sustainability', according to the Concise Oxford Dictionary, is the ability to bear weight of, hold up, keep from falling or sinking, enable to last out, give strength to, and encourage.

It is fairly common knowledge today that our environment is in a severe state of deterioration. The endless list goes from global warming, ozone depletion, polluted waters and air, acid rain, toxic chemicals, oil spills, radiation hazards, species extinction, deforestation, desertification and social ills such as AIDS, cancer, crime and poverty.

The root causes of this general assault on the environmental systems that support humanity, as identified by Brundtland and many others, are: overpopulation; continuing population growth, often with accompanying urban sprawl onto the deepest and richest agricultural soils; economic growth leading to overconsumption in the rich countries; and the use of technologies that cause too much environmental damage.

The central message of Brundtland is that development based on the exploitive expansion, or quantitative growth of these root causes is neither economically nor environmentally sustainable. It is this kind of unsustainable growth that has characterized the industrialized world, which of course includes the Region of Halton and the City of Burlington.

While the problems have a global dimension, the causes and solutions derive from local decisions and actions. If our World, Region and City hope to keep from falling or sinking, we must ensure that our future thinking and actions related to local development and growth are in harmony with the environmental systems that support us.

1.2 Background to Study

Since local governments are responsible for approving the draft plans of new residential and other developments, and for participating in longer term land-use planning, it seemed logical to focus attention at this level. It has been argued that "few areas of economic policy are likely to have a more profound effect

on the future quality of life than decisions influencing patterns of land use" (Baumol and Oates, 1979, 157).

The City of Burlington and Halton Region, are both in the process of revising their Official Plans. A mutual interest was, therefore, immediately sparked and followed up on in this study. An overall objective decided upon was to use both conceptual and empirical perspectives which would lead to a statement of principles and/or guidelines necessary to move towards sustainability.

1.3 Scope of Report

The criteria used to measure sustainability will be applied to three different eras of distinct growth and communities within the City of Burlington which were built during the following time periods. Characteristics and growth patterns of the eras and their representative communities, will be compared and contrasted in order to develop these principles of sustainability.

The downtown core of Burlington represents the 1930's-1940's. This era, during the depression and prior to World War II, was a time of little growth. It is characterized by small, tightly-knit communities, abundance and respect for land, and a largely rural and agricultural lifestyle.

The 1950's-1960's is represented by the Aldershot community. This post-war era was a time of great expansion. A migration from rural to urban environments occurred. The extensive technological growth and change, and industrial production, created an economically expanding and mobile society in which little thought was given to environmental effects.

The land use and community form of Headon Forest is representative of the 1970's and 1980's, and is still prevalent today. This era is characterized by continued expansion, urban sprawl, continued loss of prime foodlands, lack of community atmosphere, and scarce and expensive land. There is increased consumption of energy, water, land and other resources, and increased production of pollution, noise and garbage. Environmental deterioration is now a concern but still 'backseat' to economic growth.

The demographics, livelihoods and other general era characteristics are included in order to better understand the influences of the different societies. Criteria which are more indicative of sustainability; energy and water consumption, waste production, local agriculture and food supply, servicing costs, the number of motor vehicles and commuters, are then compared.

The actual growth patterns which resulted are seen in the

specific community characteristics. Aspects included consist of the house and lot sizes, road coverage, land-use diversity, and the resulting community atmospheres. This conceptual and empirical evidence leads to principles and guidelines necessary to increase the sustainability of future land use patterns.

2. GENERAL ERA CHARACTERISTICS

2.1 Demographics

2.1.1 Population and Growth Rate. The population figures are a measure of the total number of inhabitants of the specific areas, taken at some time during the year. The increase in growth during the five year intercensal periods is measured by the actual increase in numbers of people. The percentage of the population increase or the growth rate is also included.

Population figures from Canada, Ontario, the Region of Halton and the City of Burlington all indicate similar patterns of growth, (see Table 2.1). During WWI, the Great Depression and WWII periods, the growth rate was slow and gradual. The largest increase in population growth occurred after the Second World War. Since then, there has been a gradual slowdown in the expansion.

The increase in population size following the end of the second World War, is noticeable in the figures from the City of Burlington. A growth rate of 22.4% in 1951 rose to 46.8% in 1956. The 427.9% increase between 1956 and 1961 is a result of the annexation of Nelson Township in 1958. Substantial growth rates of 40.3% and 33.0% continued during 1966 and 1971 respectively.

These population and growth rate figures are necessary to show how rapidly or not so rapidly the population has grown. This is important generally, because population, together with per capita material and energy consumption rates, and the technology used to produce these consumables, are the driving factors of environmental transformation and degradation. The population trends and environmental pressures reflect the actions of the society during the respective time periods.

In this report, this importance is particularly relevant because both the City of Burlington and the Region of Halton are contemplating major increases in population, (due in large part to immigration from outside Canada), and associated development growth. A study done by Halton Region suggests that Burlington has a carrying capacity (a maximum number of people which can be supported in a specific area) of 185,000. This is estimated to be attained by the year 2021. A similar study coordinated for the Greater Toronto Area (GTA), estimates that a population of 185,000 will occur by 2011. This study suggests that Burlington will be able to support a larger population of approximately 205,000, in the year 2021, (see Figure 2.1).

Since population and development growth patterns modelled on the past are, by definition, the unsustainable patterns identified by Brundtland, the challenges of reconciling a continued expansion

with sustainability are clear. These challenges are underlined by the fact that, with few exceptions, observed local and regional government philosophy, including that of the City and Region, is unquestioning and supportive of rapid population and development growth.

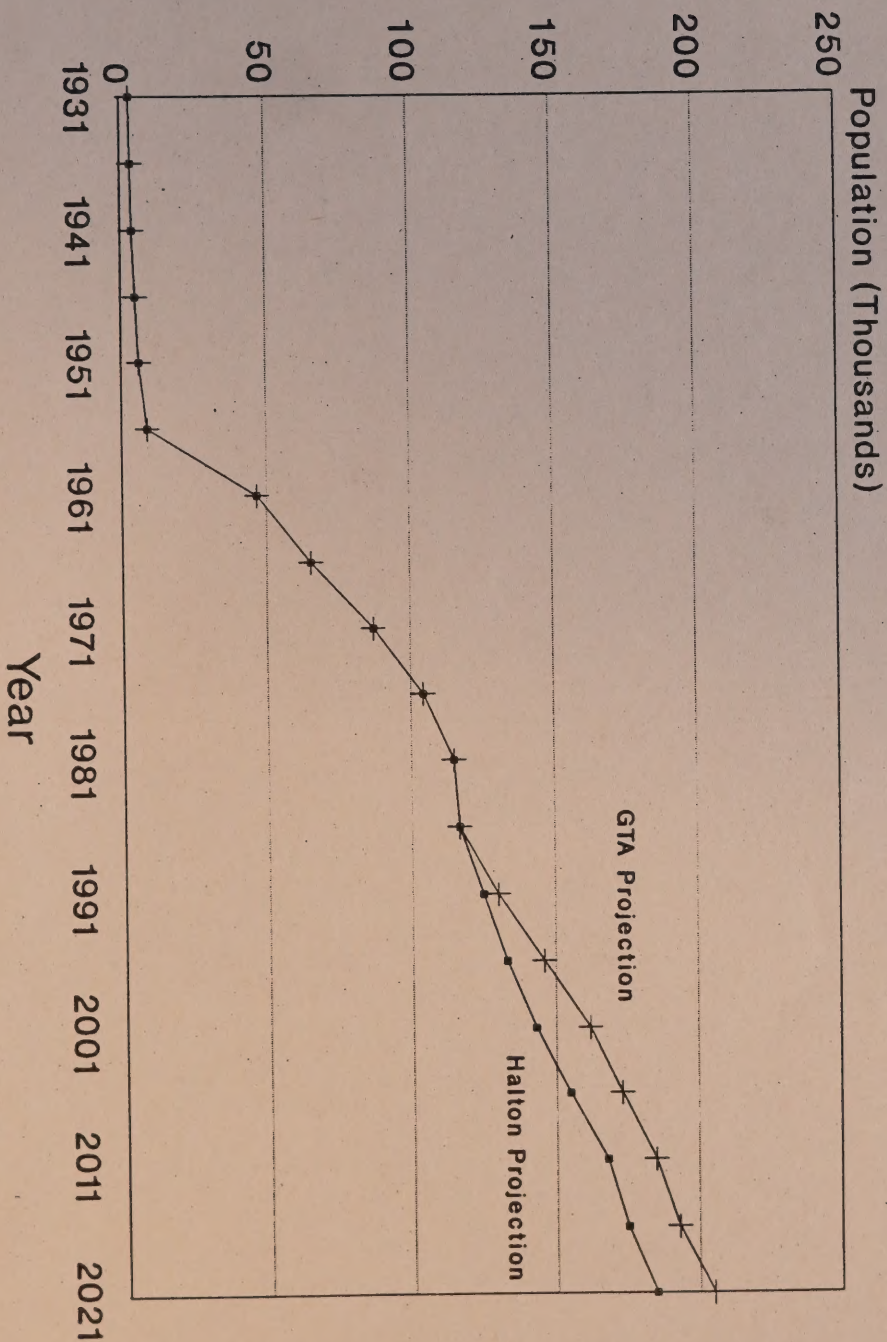
Table 2.1. The Population and Growth Rate of Canada, Ontario, the Region of Halton and the City of Burlington from 1931 to 1986.

C A N A D A				H A L T O N			
YEAR	POPULATION	INCREASE DURING FIVE YEAR PERIOD:		YEAR	POPULATION	INCREASE DURING FIVE YEAR PERIOD:	
		NO.	%			NO.	%
1931	10,376,786			1931	26,558		
1936	11,028,000	651,214	6.3	1936	27,537	979	3.7
1941	11,506,655	478,655	4.3	1941	28,515	978	3.6
1946	12,292,000	785,345	6.8	1946	37,673	9,158	32.1
1951	14,009,429	1,717,429	14.0	1951	46,830	9,157	24.3
1956	16,080,791	2,071,362	14.8	1956	71,611	24,781	52.9
1961	18,238,247	2,157,456	13.4	1961	117,623	46,012	64.3
1966	20,014,880	1,776,633	9.7	1966	151,924	34,301	29.2
1971	21,568,311	1,553,431	7.8	1971	189,850	37,926	25.0
1976	22,992,604	1,424,293	6.6	1976	228,495	38,645	20.4
1981	24,343,180	1,350,576	5.9	1981	253,885	25,390	11.1
1986	25,309,330	966,150	4.0	1986	271,389	17,504	6.9

O N T A R I O				B U R L I N G T O N			
YEAR	POPULATION	INCREASE DURING FIVE YEAR PERIOD:		YEAR	POPULATION	INCREASE DURING FIVE YEAR PERIOD:	
		NO.	%			NO.	%
1931	3,431,683			1931	3,046		
1936	3,690,000	258,317	7.5	1936	3,431	385	12.6
1941	3,787,655	97,655	2.6	1941	3,815	384	11.2
1946	4,093,000	305,345	8.1	1946	4,916	1101	28.9
1951	4,597,542	504,542	12.3	1951	6,017	1101	22.4
1956	5,404,933	807,391	17.6	1956	8,834	2817	46.8
1961	6,236,092	831,159	15.4	1961	46,636	37802	427.9
1966	6,960,870	724,778	11.6	1966	65,453	18817	40.3
1971	7,703,106	742,236	10.7	1971	87,023	21570	33.0
1976	8,264,465	561,359	7.3	1976	104,314	17291	19.9
1981	8,625,110	360,645	4.4	1981	114,853	10539	10.1
1986	9,101,695	476,585	5.5	1986	116,675	1822	1.6

Source: Statistics Canada, Census of Canada.

Figure 2.1. Population Growth and Projections for the City of Burlington, from 1931 to 2021.



Source: Statistics Canada, Census of Canada (1931-1986).
 City of Burlington, Background Report Official Plan Review
 Working Group (1991-2021 projections).

2.12 Urban and Rural Population. The urban and rural population figures are a measure of the number of inhabitants in each of the designated areas. The rural population figures include both farm and non-farm uses.

In Halton Region, in 1931, there were more rural residents than urban residents. The urban portion, which made up 48.2% of the total population in 1931, made up 88.9% percent of the population in 1986. This migration from rural to urban living has occurred throughout Ontario and Canada as well.

This migration was largely forced by the mechanization of agriculture. The resultant cost pressures increased specialization and the minimum economic farm size. Adding in the large increases in output per acre, derived from and dependent upon the heavy use of chemical fertilizers, biocides, and high yield strains, simply meant that fewer farms and farmers were needed and viable. Present patterns of development and land use change continue to depopulate and irreversibly convert rural, agricultural areas.

A rural lifestyle implies a greater connection with the land. Dependency on the natural environment is an ingrained part of the daily routine of rural living. For many rural inhabitants, the land provides them with their source of livelihood.

In an urban atmosphere, often the only natural "green" space in the daily routine is mowed lawns or groomed and landscaped parks. Food is bought in a grocery store and very rarely do we see where it comes from. As our society moves to a largely urban population we lose more and more of our relationship with the land.

2.13 Households and Family Sizes. The average number of people living in a household has decreased over the years. This general trend is apparent in Canada, Ontario and the City of Burlington, (see Table 2.3). An average of 3.7 persons per household in Burlington, in 1941, was reduced to 2.8 in 1986.

An overall decrease in family size as well as household size, has also occurred, (see Table 2.4). The average number of children per family in Burlington, in 1966 was 1.9. This has decreased to an average of 1.3 in 1986.

Demographic statistics are effective indicators of social trends. Households, and family sizes have decreased probably for numerous reasons. Children once used to be economically beneficial. A large family could better operate a family farm. Now, with a dominant urban population, a substantially higher cost of living, and the need for both spouses to work, children become more of an economic burden.

The trend towards smaller household sizes and fewer children should be reflected in the appropriate housing which is required,

but this is not the case. The community of Headon Forest, which was build primarily during the 1980's, has the largest average dwelling size, (as shown in section 4.1). This is a further example of our society's overconsumptive and materialistic values.

Table 2.2 The Urban and Rural Population of Canada, Ontario and the Region of Halton, from 1931 to 1986.

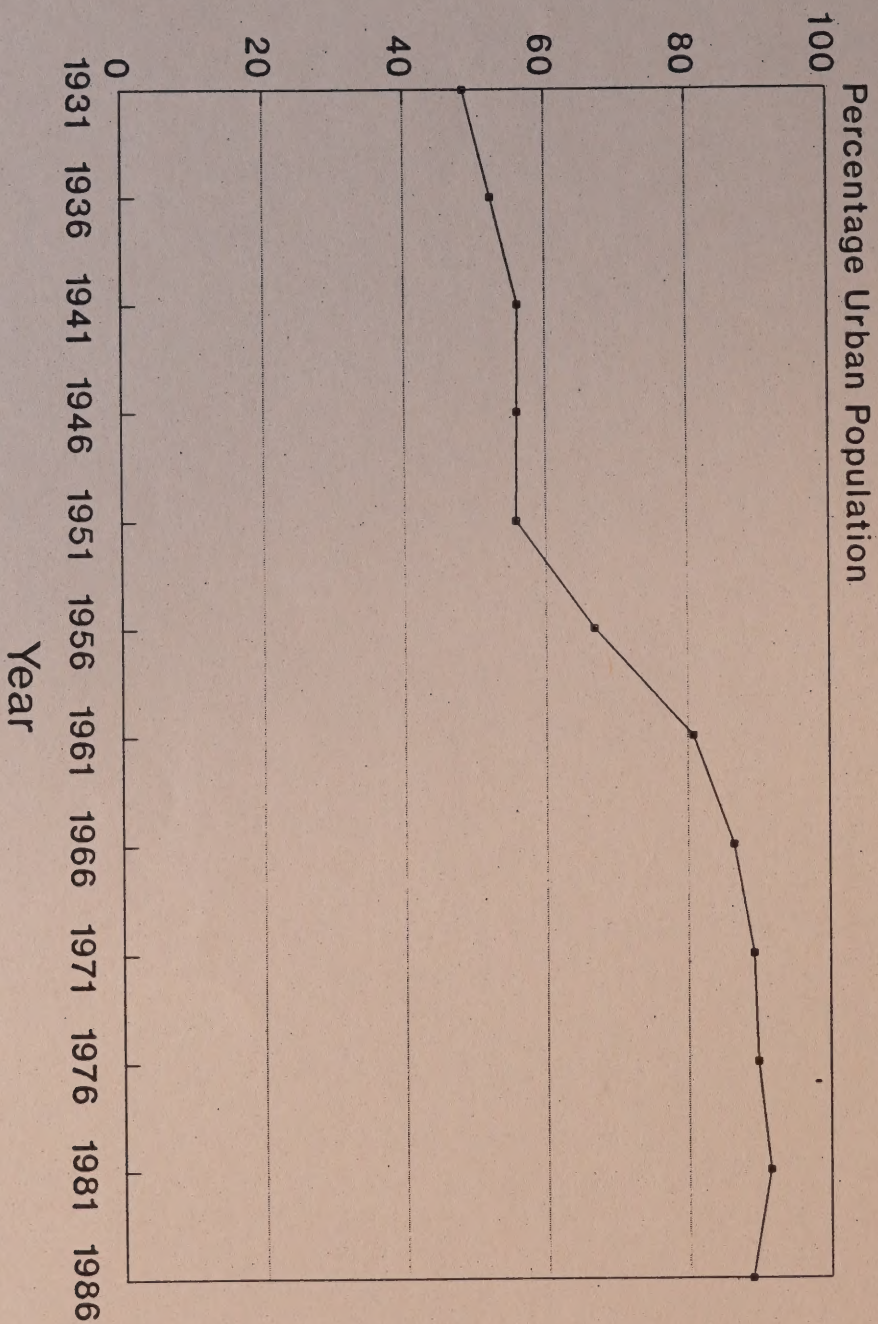
C A N A D A				
YEAR	TOTAL POPULATION	URBAN POPULATION	RURAL POPULATION	PERCENT URBAN POPULATION
1931	10,376,786	5,572,058	4,804,728	53.7
1941	11,506,655	6,252,416	5,254,239	54.3
1951	14,009,429	7,941,222	6,068,207	56.7
1956	16,080,791	7,941,222	6,794,665	49.4
1961	18,238,247	11,068,848	7,169,399	60.7
1966	20,014,880	12,624,784	7,389,096	63.1
1971	21,568,311	14,114,970	7,453,340	65.4
1976	22,992,604	17,366,970	5,625,635	75.5
1981	24,343,180	18,435,927	5,907,254	75.7
1986	25,309,330	19,352,085	5,957,245	76.5

O N T A R I O				
YEAR	TOTAL POPULATION	URBAN POPULATION	RURAL POPULATION	PERCENT URBAN POPULATION
1931	3,431,683	2,095,992	1,335,691	61.1
1941	3,787,655	2,338,633	1,449,022	61.7
1951	4,597,542	3,251,099	1,346,443	70.7
1956	5,404,933	4,102,919	1,302,014	75.9
1961	6,236,092	4,823,529	1,412,563	77.3
1966	6,960,870	5,593,440	1,367,430	80.4
1971	7,703,106	6,343,630	1,359,475	82.4
1976	8,264,465	6,771,309	1,493,156	81.9
1981	8,625,110	7,047,032	1,578,075	81.7
1986	9,101,695	7,469,420	1,632,275	82.1

H A L T O N				
YEAR	TOTAL POPULATION	URBAN POPULATION	RURAL POPULATION	PERCENT URBAN POPULATION
1931	26,558	12,885	13,673	48.5
1941	28,515	16,006	13,996	56.1
1951	46,830	26,148	17,855	55.8
1956	71,611	47,877	20,420	66.9
1961	117,611	94,946	12,021	80.7
1966	151,924	131,277	9,323	86.4
1971	189,850	169,320	20,535	89.2
1976	228,495	205,070	23,430	89.7
1981	253,885	232,240	21,643	91.5
1986	271,389	241,122	30,267	88.8

Source: Statistics Canada, Census of Canada.

Figure 2.2 The Percentage of Urban Population in the Region of Halton, from 1931-1986.



Source: Statistics Canada, Census of Canada.

Table 2.3 The Number of Households in Canada, Ontario and the City of Burlington, from 1941 to 1986.

C A N A D A		
YEAR	NUMBER OF HOUSEHOLDS	AVERAGE # OF PERSONS PER HOUSEHOLD
1941	2,706,089	4.3
1951	3,409,284	4.0
1956	3,923,646	3.9
1961	4,554,736	3.9
1966	5,180,473	3.7
1971	6,041,305	3.5
1976	7,166,095	3.1
1981	8,281,530	2.9
1986	8,991,670	2.8

O N T A R I O		
YEAR	NUMBER OF HOUSEHOLDS	AVERAGE # OF PERSONS PER HOUSEHOLD
1941	969,267	3.9
1951	1,181,126	3.8
1956	1,392,491	3.8
1961	1,640,881	3.7
1966	1,876,545	3.6
1971	2,228,160	3.4
1976	2,634,620	3.1
1981	2,969,785	2.8
1986	3,221,730	2.8

B U R L I N G T O N		
YEAR	NUMBER OF HOUSEHOLDS	AVERAGE # OF PERSONS PER HOUSEHOLD
1941	1,033	3.7
1951	1,728	3.5
1956	2,596	3.5
1961	12,299	3.8
1966	17,171	3.8
1971	23,810	3.6
1976	31,660	3.3
1981	37,885	3.0
1986	40,145	2.9

Source: Statistics Canada,
Census of Canada.

Table 2.4 The Average Family Size in Canada, Ontario and the City of Burlington, from 1931 to 1986.

C A N A D A			
YEAR	NUMBER OF FAMILIES	AVERAGE # OF PERSONS PER FAMILY	AVERAGE # OF CHILDREN PER FAMILY
1931	2,419,360	3.9	2.9
1941	2,525,299	3.9	1.9
1951	3,287,384	3.7	1.7
1956	3,711,500	3.8	1.8
1961	4,147,444	3.9	1.9
1966	4,526,266	3.9	1.9
1971	5,070,680	3.7	1.8
1976	5,727,895	3.5	1.6
1981	6,325,000	3.3	1.4
1986	6,813,700	3.1	1.3

O N T A R I O			
YEAR	NUMBER OF FAMILIES	AVERAGE # OF PERSONS PER FAMILY	AVERAGE # OF CHILDREN PER FAMILY
1931			
1941	909,210	3.6	1.5
1951	1,162,772	3.4	1.4
1956	1,342,572	3.5	1.5
1961	1,511,478	3.6	1.6
1966	1,657,933	3.7	1.7
1971	1,881,840	3.6	1.7
1976	2,104,541	3.4	1.5
1981	2,279,000	3.2	1.4
1986	2,496,000	3.1	1.3

B U R L I N G T O N			
YEAR	NUMBER OF FAMILIES	AVERAGE # OF PERSONS PER FAMILY	AVERAGE # OF CHILDREN PER FAMILY
1931			
1941	995	3.8	1.4
1951	1,651	3.6	1.3
1956	2,443	3.6	1.5
1961	11,837	3.9	1.7
1966	16,177	4.0	1.9
1971	21,765	4.0	1.7
1976	27,615	3.8	1.6
1981	31,705	3.6	1.4
1986	33,005	3.5	1.3

Source: Statistics Canada,
Census of Canada.

2.2 Livelihoods

The character of the Canadian and Ontario Labour Force indicates the various livelihoods which were predominant during the past time periods. The number of people in the labour force has increased in relation to the population growth. A significant change is seen in Table 2.5. Even though population and labour force have increased, the people employed in agricultural pursuits have decreased. This decrease in agricultural employees has been quite substantial. In 1931, 7.8% of the entire Ontario population was involved in agriculture. This was reduced to 1.7% in 1971.

A further breakdown of the labour force, by occupation, gives a better indication of the livelihoods in the past. Similar patterns exist in Canada and Ontario, (see Table 2.6 and Table 2.7). In Canada, during 1931 and 1941, the largest portion of the population was employed in primary industries. Agriculture, as an individual category, had the highest percent of the labour force in both Canada and Ontario in 1931.

During the 1950's and 1960's, the shift moved away from agriculture and primary industries as a whole. In Canada and Ontario, white collar workers became the largest portion of the labour force. The blue collar industrial group was at its peak percentage employment during this period.

The 1970's and 1980's has continued the increase in white collar workers. This group of occupations is now most dominant with 49.4 % of the labour force in Ontario in 1981. Primary industries have continued their decrease. In 1981, in Ontario, only 4.2% of the labour force was employed in primary occupations, with only 3.5% in agriculture.

2.3 Income Levels

The average wages and salaries are indicators of economic sustainability throughout the past years. Since 1931, the average income has increased substantially. In Ontario, an annual income of \$1,275 in 1939, rose to \$22,927 in 1986.

Not only have wages increased, but the rate of their inflation has also enlarged. The average annual salary in Ontario increased by 26.4% between 1981 and 1986, but the inflation rate between 1981 and 1986, based on the Consumer Price Index, increased by 32.4% (Statistics Canada, Canadian Economic Observer, 1986, 43).

Another significant change has taken place within the family income. In 1941, the family income in Ontario consisted of 94.4% of an individual's income. This indicates that the majority of families were run on one salary. In 1986, a family income consisted of 50.4% of an individual's income. The majority of a family's income now comes from two salaries.

Table 2.5 The Labour Force Characteristics of Canada and Ontario
(thousands of persons), from 1931 to 1986.

C A N A D A									
YEAR	POPULATION		TOTAL LABOUR FORCE	TOTAL EMPLOYED	EMPLOYED IN:		TOTAL UNEM- PLOYED	UNEM- PLOYMENT RATE	PERCENT OF TOTAL POPULATION EMPLOYED IN AGRICULTURE
	TOTAL POPULATION AND OVER	14 YEARS AND OVER			AGRI- CULTURE	NON-AGRI- CULTURE			
1931	10,377	7,116	4,151	3,670	1,216	2,454	481	11.6	11.72
1936	11,028	7,748	4,466	3,895	1,319	2,576	571	12.8	11.96
1941	11,507	8,056	4,466	4,271	1,224	3,047	195	4.4	10.64
1946	12,292	8,779	4,829	4,666	1,186	3,480	163	3.4	9.65
1951	14,009	9,732	5,223	5,097	939	4,158	126	2.4	6.70
1956	16,081	10,807	5,782	5,585	777	4,808	197	3.4	4.83
1961	18,238	12,053	6,521	6,055	681	5,374	466	7.1	3.73
1966	20,015	13,475	7,420	7,152	544	6,609	267	3.6	2.72
1971	21,568	15,385	8,631	8,079	510	7,569	552	6.4	2.36
1976	22,993	16,873	10,308	9,572	-	-	736	7.1	-
1981	24,343	18,295	11,830	10,933	-	-	909	7.6	-
1986	25,309	19,594	12,870	11,634	-	-	1,236	9.6	-

O N T A R I O									
YEAR	POPULATION		TOTAL LABOUR FORCE	TOTAL EMPLOYED	EMPLOYED IN:		TOTAL UNEM- PLOYED	UNEM- PLOYMENT RATE	PERCENT OF TOTAL POPULATION EMPLOYED IN AGRICULTURE
	TOTAL POPULATION AND OVER	14 YEARS AND OVER			AGRI- CULTURE	NON-AGRI- CULTURE			
1946	4,093	-	1,702	1,654	319	1,335	48	2.8	7.79
1951	4,597	-	1,870	1,838	238	1,600	32	1.7	5.18
1956	5,405	-	2,147	2,096	213	1,883	51	2.4	3.94
1961	6,236	-	2,401	2,269	162	2,107	132	5.5	2.60
1966	6,961	-	2,719	2,651	141	2,510	69	2.5	2.03
1971	7,703	-	3,249	3,079	134	2,945	170	5.2	1.74
1976	8,264	-	3,931	3,689	-	-	242	6.2	-
1981	8,625	-	4,481	4,186	-	-	295	6.6	-
1986	9,102	-	4,897	4,555	-	-	342	7.0	-

Source: Statistics Canada, Historical Statistics of Canada, 2nd ed. (1931-1976).
Statistics Canada, Census of Canada (1981-1986).

Table 2.6 The Canadian Labour Force, 15 years and over, by Percent Occupation, from 1931 to 1981.

	1931	1941	1951	1961		1971	1981
ALL OCCUPATIONS	3908117	4183557	5276639	6458156	ALL OCCUPATIONS	8626925	12005320
	100%	100%	100%	100%		100%	100%
WHITE COLLAR WORKERS	24.5	25.3	32.0	37.9	WHITE COLLAR WORKERS	41.2	47.9
Proprietary & Managerial	5.6	5.4	7.4	7.8	Managerial & Administrative	4.3	6.8
Professional	6.1	6.7	7.3	9.8	Natural Sciences,		
					Engineering & Mathematics	2.7	3.4
					Medicine & Health	3.8	4.3
					Teaching	4.0	4.1
					Social Sciences	0.9	1.6
Clerical	6.7	7.3	10.7	12.7	Clerical	15.9	18.2
Commercial & Financial	6.1	5.9	6.6	7.6	Sales	9.5	9.5
BLUE COLLAR WORKERS	27.5	27.1	29.4	26.6	BLUE COLLAR WORKERS	24.3	19.9
Manufacturing & Mechanical	11.6	16.1	17.2	16.1	Processing	3.9	0.0
					Machining	2.8	2.6
					Product Fabricating	7.4	7.7
Construction	4.7	4.7	5.5	5.2	Construction Trades	6.6	6.4
Labourers	11.3	6.3	6.6	5.3	Material Handling	2.4	2.0
					Other Crafts	1.3	1.2
TRANSPORTATION AND COMMUNICATION	6.3	6.4	7.8	7.7	TRANSPORTATION EQUIPMENT AND OPERATIONS	3.9	3.8
SERVICE	9.3	10.5	9.8	12.4	SERVICE	12.4	13.6
					Service	11.2	11.9
					Artistic, Literary & Recreational	0.9	1.4
					Religion	0.3	0.3
PRIMARY	32.4	30.5	19.8	12.9	PRIMARY	7.7	5.9
Agriculture	28.6	25.7	15.7	10.0	Farming, Horticulture & Animal Husbandry	5.9	4.2
Fishing, Hunting & Trapping	1.2	1.2	1.0	0.6	Fishing, Hunting & Trapping	0.3	0.3
Logging	1.1	1.9	1.9	1.2	Forestry & Logging	0.8	0.7
Mining & Quarrying	1.5	1.7	1.2	1.0	Mining, Quarrying, Oil & Gas Field Operations	0.7	0.6
NOT STATED	0.0	0.3	1.2	2.6	NOT ELSEWHERE CLASSIFIED	1.9	1.5
					NOT STATED	8.5	3.5

Source: Statistics Canada, Census of Canada.

Table 2.7 The Ontario Labour Force, 15 years and over, by Percent Occupation, from 1931 to 1981.

	1931	1941	1951	1961		1971	1981
ALL OCCUPATIONS	1343103	1452071	1882508	2393015	ALL OCCUPATIONS	3354360	4472825
	100%	100%	100%	100%		100%	100%
WHITE COLLAR WORKERS	27.7	29.0	35.6	41.0	WHITE COLLAR WORKERS	43.5	49.4
Proprietary & Managerial	6.1	5.8	8.0	8.1	Managerial & Administrative	4.7	7.2
Professional	6.3	6.9	7.5	10.0	Natural Sciences,		
					Engineering & Mathematics	3.1	3.7
					Medicine & Health	3.7	4.1
					Teaching	3.8	3.9
					Social Sciences	1.0	1.7
Clerical	8.3	9.7	13.0	14.7	Clerical	17.6	19.3
Commercial & Financial	7.0	6.7	7.0	8.2	Sales	9.6	9.6
BLUE COLLAR WORKERS	31.5	32.5	33.6	28.5	BLUE COLLAR WORKERS	25.9	24.7
Manufacturing & Mechanical	15.3	21.0	21.4	18.4	Processing	3.7	3.7
					Machining	3.8	3.3
					Product Fabricating	8.3	8.7
Construction	5.1	4.8	5.5	5.0	Construction Trades	6.2	5.5
Labourers	11.1	6.7	6.8	5.1	Material Handling	2.5	2.3
					Other Crafts	1.4	1.3
TRANSPORTATION AND					TRANSPORTATION EQUIPMENT		
COMMUNICATION	6.8	6.4	7.4	6.9	AND OPERATIONS	3.6	3.4
SERVICE	9.2	10.3	9.6	12.4	SERVICE	11.8	13.3
					Service	10.6	11.6
					Artistic, Literary &		
					Recreational	1.0	1.5
					Religion	0.2	0.2
PRIMARY	24.7	21.5	12.9	8.9	PRIMARY	5.2	4.2
Agriculture	22.6	18.5	10.8	7.2	Farming, Horticulture &		
					Animal Husbandry	4.3	3.5
Fishing, Hunting & Trapping	0.5	0.4	0.2	0.1	Fishing, Hunting & Trapping	0.0	0.0
Logging	0.6	1.0	0.9	0.5	Forestry & Logging	0.3	0.3
Mining & Quarrying	1.1	1.6	1.1	1.1	Mining, Quarrying, Oil &		
					Gas Field Operations	0.6	0.4
NOT STATED	0.1	0.3	1.0	2.3	NOT ELSEWHERE CLASSIFIED	2.3	1.8
					NOT STATED	7.7	3.2

Source: Statistics Canada, Census of Canada.

Table 2.8 Income Levels of Canada and Ontario from 1931 to 1986.

C A N A D A				
YEAR	AVERAGE WEEKLY WAGES (Dollars)	AVERAGE ANNUAL INCOME (Dollars)	AVERAGE ANNUAL FAMILY INCOME (Dollars)	PORTION OF INDIVIDUAL INCOME IN FAMILY INCOME (%)
Based on the 1948 Standard Industrial Classification				
1931			1,366	
1939	23.44	1,222		
1941	26.65	1,390	1,411	98.5
1946	32.48	1,694		
1951	50.04	2,609	3,535	73.8
1956	64.44	3,360		
1961	78.11	4,073	5,317	76.6
Based on th 1960 Standard Industrial Classification				
1961	78.24	4,079		
1966	96.34	5,023	7,602	66.1
1971	137.64	7,177	10,368	69.2
1976	228.03	11,889	20,101	59.1
1981	355.28	18,524	30,440	60.9
1986	430.91	22,468	40,356	55.7
O N T A R I O				
YEAR	AVERAGE WEEKLY WAGES (Dollars)	AVERAGE ANNUAL INCOME (Dollars)	AVERAGE ANNUAL FAMILY INCOME (Dollars)	PORTION OF INDIVIDUAL INCOME IN FAMILY INCOME (%)
Based on the 1948 Standard Industrial Classification				
1931			1,436	
1939	24.45	1,275		
1941	28.02	1,461	1,548	94.4
1946	32.59	1,699		
1951	51.69	2,695	3,903	69.1
1956	66.86	3,486		
1961	81.14	4,231	5,773	73.3
Based on th 1960 Standard Industrial Classification				
1961	81.30	4,239		
1966	99.40	5,183	8,438	61.4
1971	143.02	7,457	11,483	64.9
1976	228.72	11,925	21,600	55.2
1981	347.92	18,141	32,170	56.4
1986	439.72	22,927	45,078	50.9

Source: Statistics Canada, Canadian Economic Observer (average weekly wages and average annual income).

Statistics Canada, Census of Canada (average family income).

2.4 Housing Prices

The price of houses is another indicator of economic sustainability throughout the past. Over time, the real estate market has become extremely inflated. Combined with higher interest and mortgage rates, this inflation has made owning a house much more of an economic burden, if possible at all.

The price of an average single-family dwelling in 1930 was \$2,000 (see Table 2.10). This has risen to an average of \$85,360 in Canada. Average prices in Burlington and the surrounding urban areas, all indicate a range above \$115,000 in 1986. Since then, the inflation has continued to increase substantially.

Table 2.9 The Price Range Distribution of New Houses (single-detached dwellings only), in Canada from 1961 to 1986.

PRICE RANGE (Dollars)	1961	1966	1971	1971	1976	1981	1986
0- 12,999	30.3	3.7	2.1				
13- 14,999	28.2	15.8	9.1				
15- 16,999	24.1	21.6	11.6				
17- 18,999	11.3	21.6	11.3				
19- 20,999		15.0	11.6				
21- 22,999		10.3	12.4				
23- 24,999		6.3	11.4				
25- 26,999		3.4	9.0				
27- 28,999	6.1		7.0				
29- 30,999			5.4				
31- 32,999		2.5	4.0				
33,000+			5.1				
0- 49,999				99.4	86.7	33.6	2.8
50- 59,999				0.3	8.7	20.3	8.6
60- 69,999				0.1	3.3	13.9	19.3
70- 79,999				0.1	1.0	11.4	22.3
80- 89,999					0.2	9.9	15.7
90- 99,999					0.1	4.8	10.8
100-119,999				0.1	<0.1	4.3	10.1
120-139,999					<0.1	1.3	5.5
140,000+					-	0.5	4.9
TOTAL	100%	100%	100%	100%	100%	100%	100%
AVERAGE PRICE(\$)	14,727	18,381	22,219	21,979	37,877	63,370	85,360

Source: Canadian Mortgage and Housing Corporation.

Table 2.10 Average Price of a Single-family Dwelling (dollars), in Canada and Selected Areas, from 1930-1986.

	1930	1951	1956	1961	1966	1971	1976	1981	1986
Hamilton				14,078	19,947	28,429	50,617	69,447	121,073
Toronto				17,301	23,056	32,567	63,931	87,483	126,587
Burlington								85,085	119,208
Total Metropolitan Areas				14,840		38,511	38,511	64,244	87,397
Other Areas				6,852		37,202	37,202	61,179	80,832
Canada	2,000	10,948	13,854	14,891	18,059	22,912	37,877	63,370	85,360

Source: Berton, P., Canadian Geographic (1930 price).
J. M. Edwards Associates Inc. (1981 and 1986 Burlington prices).
Canadian Mortgage and Housing Corporation (remaining prices).

3. INDICATORS OF SUSTAINABILITY

3.1 Electrical Energy Consumption

"Canadians are used to seemingly limitless cheap energy. There is little incentive to conserve so we waste it, using twice per capita as much as Japan or Sweden" (Suzuki,1990). The rate of electrical energy consumption in Ontario is used as an example of the increased demand, as seen in Table 3.1. Since the amounts of energy involved are very large, multiples of the basic watt and watt-hour are used. The following equivalences explain further;

Power: 1 kilowatt (kW) = 1,000 watts
 1 megawatt (MW) = 1,000 kilowatts

Energy: 1 kilowatt-hour (kWh) = 1,000 watt-hours
 1 megawatt-hour (MWh) = 1,000 kilowatt-hours

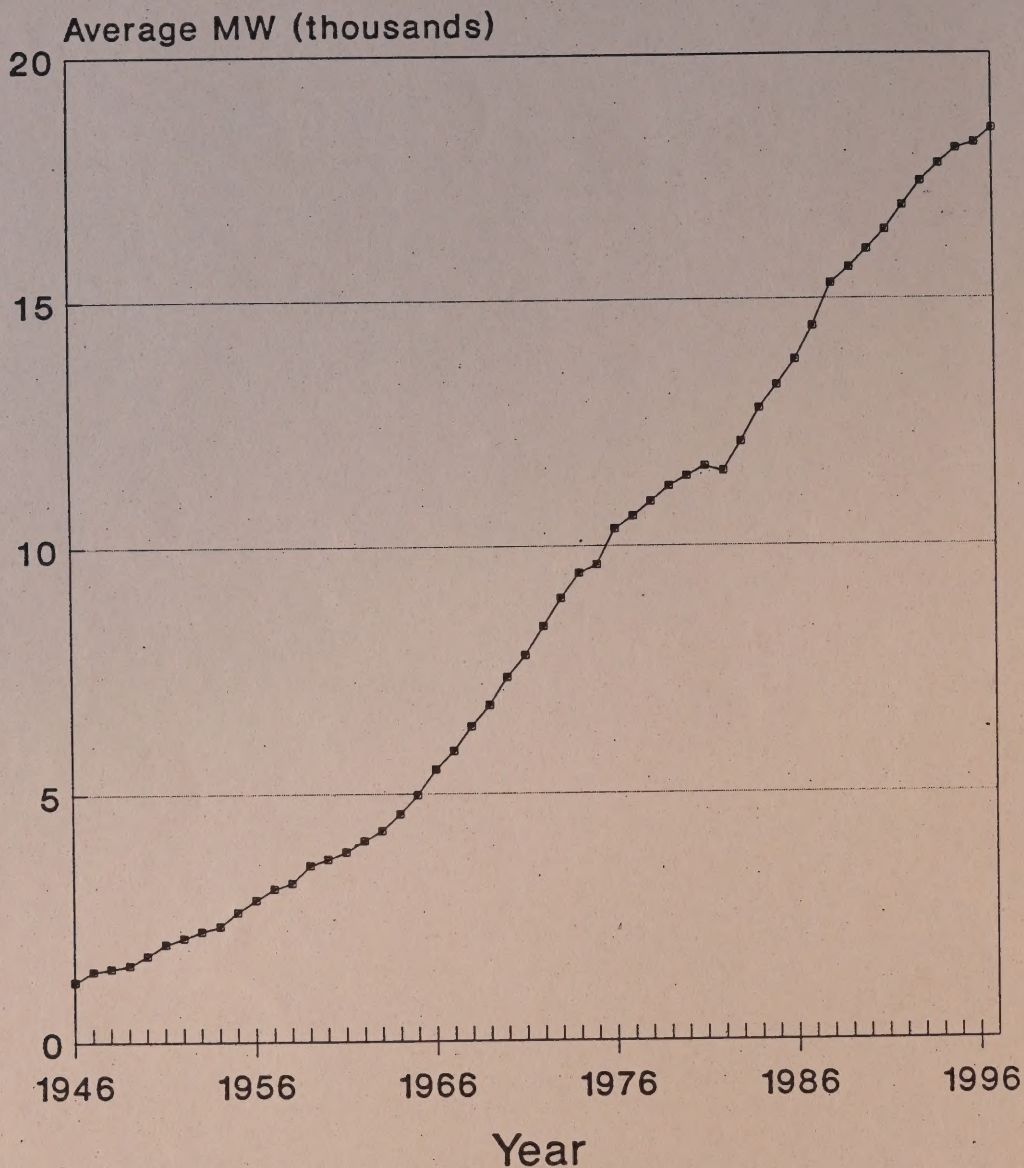
The annual energy consumed is given in two forms. The megawatt-hours expresses the total amount of energy demand per year. The average megawatt represents the average total power used per hour. The figures which represent the annual energy per person are the annual energy demands divided by the total population.

Electricity consumption, as well as total energy use, has grown dramatically since the end of World War II. Several important contributing factors affect this changing electricity consumption, such as the use of electricity rather than other fuels, increased technological requirements, increased population and an economic system based on growing consumerism and materialism.

The yearly average megawatt demand along with the Load Forecasts are shown Figure 3.1. Ontario Hydro estimates that "by the year 2014-only a quarter of a century away-we Ontarians will be needing some 50 to 100 per cent more electric power then we use today" (Ontario Hydro,1989,4). These estimates are all based on continued growth in population, economic activity and inherent environmental impacts.

It is also estimated that by 2014, between 20 percent and 30 percent of Hydro's major supply stations will have to be retired (Ontario Hydro,1989). Although these estimates are the rationale behind Ontario Hydro's plans for new nuclear power plants and rate increases, (since in their forecasts they do not consider questions of sustainability), they could also be the rationale behind energy efficiencies, reduced demand and alternate renewable energy sources such as solar and wind power. "More efficient use of energy can save more than two times the output of the four nuclear plants at the Darlington facilities" (Suzuki,1990).

Figure 3.1 Annual Ontario Electrical Energy Consumption and Load Forecast Estimate, from 1946 to 1997.



Source: Ontario Hydro, Load Forecast Report No.871214.

Our standard of living does not have to decrease in order to reduce our consumption. This was dramatically shown during the energy crisis. GNP and energy use do not have to increase in lock-step. Between 1973 and 1983, for example, major reductions in energy use per unit of economic activity were realized worldwide, with Japan showing the most improvement and Canada the least (El-Hainnawi and Hashmi, 1987, 86; Muir, 1989).

Table 3.1 The Primary Electricity Demands of Ontario, from 1946 to 1986.

YEAR	POPULATION	20 min. ANNUAL PEAK MW	ANNUAL ENERGY:		ANNUAL ENERGY PER PERSON:	
			MW.h	AVERAGE MW	MW	AVERAGE kW
1946	4,093,000	2,036.1	10,575,379.3	1,207.2	2.58	0.29
1951	4,597,542	3,063.1	17,241,303.9	1,968.1	3.75	0.43
1956	5,404,933	4,468.8	25,135,134.1	2,861.4	4.65	0.53
1961	6,236,092	5,902.9	33,569,282.4	3,831.9	5.38	0.61
1966	6,960,870	8,565.6	48,054,384.4	5,485.7	6.90	0.79
1971	7,703,106	11,534.5	68,132,582.0	7,777.7	8.84	1.01
1976	8,264,465	15,895.3	90,851,705.2	10,343.0	10.99	1.25
1981	8,625,110	17,189.0	101,658,168.0	11,604.8	11.79	1.35
1986	9,101,695	20,668.0	120,573,918.0	13,764.1	13.25	1.51

Load Forecast Estimates:

1991	24,426.0	143,633,700.0
1996	26,454.0	159,178,900.0

Source: Ontario Hydro, Load Forecast Report No. 871214.

3.2 Water Consumption

Water use is another measure of sustainability. As a population enlarges, the demand from the water supply also increases. In the past, it is not only the demand, but also the amount used per person which has increased.

Water from the treatment plants is used for a variety of purposes. Classifications include three main subgroups: residential, industrial and commercial. A fourth category, other, includes amounts lost and unaccounted for. In Burlington, the residential category accounts for 52% of the requirements, commercial/industrial use accounts for 32%, and 16% for other (Kalinauskas and Rivers, 1989).

The 1958 Budget from the City of Burlington states that the annual consumption of water was 758,062,000 Imperial Gallons for that year. Serving a population of 34,257 (inside and outside the municipality), this amount to an average use of 60.6 gallons/person/day. This includes all residential, industrial and commercial uses.

The average water pumped per day in 1988 was 67,255 cubic metres. This figure was provided by the City of Burlington Public Works Department and is based on average day production which does not include backwash. Serving a population of 118,546 in 1988, this amounts to an average use of 0.57 cubic metres or 124.8 gallons/person/day, and also includes all uses. In thirty years, water consumption has more than doubled.

Canadian pay about one quarter of what Europeans pay for water (Kalinauskas and Rivers, 1989). This cheap and abundant water supply does little to encourage conservation. With consumerism, materialism and technological growth it is now common for houses to have dishwashers, water softeners, washing machines, garbage disposal units, sprinkler systems, swimming pools etc. It is not surprising that our individual water consumption has increased. Water efficient devices and simple conservation strategies would reduce our wasteful habits as well as ensuring our water supply for the future.

3.3 Garbage Production and Disposal

The amount of garbage which is produced is directly related to the amount of money that a City's Budget allots for waste collection and disposal. Prior to 1974, the City of Burlington was responsible for both collection and disposal. The Region of Halton took over the disposal of garbage after 1974, but the 1990 disposal costs in the comparison in Table 3.2, are specific to Burlington.

The annual cost per person for waste collection in 1964 was \$1.47. This has risen to \$9.16 in 1990, which is a 523% increase in 26 years. The disposal costs per person have been even more substantial. A cost of \$0.45 in 1964 is now \$45.80 in 1990. This is an increase of 10,078%. As local landfill sites reach capacity, garbage must be disposed of further and further away. These exporting costs are an influencing factor to inflated prices.

Even though the cost of supplying these services has increased, our garbage production still increases. In 1990, there will be an average of 405 kilograms of garbage produced per person, per year, (based on an estimate of 48,600 tonnes to be produced). This includes and averages all residential, industrial and commercial production.

An article written in 1920 states that "The quantity of garbage produced per capita annually varies with the climate and the nature of the community, but 190 to 200 pounds is a satisfactory and approximate estimate" (Moore, 1920, 529). 200 pounds is equal to 90.7 kilograms. A satisfactory estimate of per person garbage production has risen over 300 kilograms since the 1920's. This excessive garbage production is another characteristic of our wasteful, consumptive society.

Table 3.2 The Waste Collection and Waste Disposal Costs (dollars), of the City of Burlington, for 1964 and 1990.

	1 9 9 0		
	WASTE COLLECTION	WASTE DISPOSAL	TOTAL WASTE COLLECTION AND DISPOSAL
TOTAL AMOUNT BUDGETED	1,100,000.00	5,500,000.00	6,600,000.00
Cost Per Person (Population of 120,087)	9.16	45.80	54.96
Cost Per Household (2.8 persons per household)	25.64	128.21	153.85
Cost Per Tonne (48,600 tonnes produced)	22.63	116.50	139.13

	1 9 6 4		
	WASTE COLLECTION	WASTE DISPOSAL	TOTAL WASTE COLLECTION AND DISPOSAL
TOTAL AMOUNT BUDGETED	81,704.00	25,086.00	106,790.00
Cost Per Person (Population 55,580)	1.47	0.45	1.92
Cost Per Household (3.9 persons per household)	5.73	1.76	7.49
Cost Per Tonne		n/a	

Source: Corporation of the City of Burlington, 1964 and 1990 Budgets.

3.4 Agriculture

The various agricultural statistics for Ontario and the Region of Halton were obtained from the Census of Canada. The figures prior to 1981 refer to Census Farms only. A Census Farm is defined as a holding of one acre or more with sales of agricultural

products valued at \$50 or more, during the twelve months preceding the Census date of June 1. Commercial Farms, which are farms with sales valued at \$2500 or more, became a separate category during the 1961 Census, until recombined in 1981. This accounts for the increase in numbers at the 1981 Census Year.

In The Region of Halton, there has been a loss of 39,790 hectares (98,320 acres) of farm area from 1931-1986. This is a 38.9% decrease in farm area and an average loss of 723 hectares (1,788 acres) per year. This average yearly loss is greater than the total ten year loss between 1931 and 1941.

The number of occupied farms, in The Region of Halton, has also decreased significantly. In 1931 there were 2,344 farms, whereas in 1986 there were 834 occupied farms. This is a loss of 1,510 farms since 1931, and an average yearly loss of 27.5 farms.

A further breakdown of Halton indicates more specifically when these losses took place;

Table 3.3 The Number of Occupied Farms and Farm Area Lost in the Region of Halton, from 1931 to 1986.

	NUMBER OF OCCUPIED FARMS LOST	ACRES	FARM AREA LOST HECTARES
1931-1941	92	1,518	614
1941-1951	217	11,028	4,463
1951-1961	697	41,302	16,714
1961-1971	230	36,365	14,717
1971-1986	274	8,107	3,282

Source: Table 3.4.

Another significant feature which has undergone change is the tenure of census farms. Since 1931 there has been a shift away from owner occupied farms. In Halton, in 1931, 83% of the occupied farms were operated by the owner. This has decreased to 63.5% in 1986. This is due in large part to urban development pressures. Land speculators buy the land, then leave it idle or rent it to the farmers, until zoning changes and the housing market makes it profitable to subdivide.

Development that is sustainable, is able to meet the needs of the present without compromising the needs of future generations. If population projections are made into reality, we will have a substantially larger number of people to feed. Our ability to supply the basic human need of healthy food is endangered when we continue to build and pave over our remaining agricultural land.

Table 3.4 The Total Farm Area of Ontario and the Region of Halton, from 1931 to 1986.

O N T A R I O					
YEAR	TOTAL FARM AREA		DECREASE DURING INTERCENSAL PERIOD		
	ACRES	HECTARES	ACRES	HECTARES	PERCENT
1931	22,840,898	9,243,483			
1941	22,387,981	9,060,192	452,917	183,291	2.0
1951	20,880,054	8,449,949	1,507,927	610,243	6.7
1956	19,879,646	8,045,094	1,000,408	404,855	4.8
1961	18,578,507	7,518,536	1,301,139	526,558	6.5
1966	17,826,045	7,213,945	752,462	304,591	4.1
1971	15,963,056	6,406,019	1,862,989	807,926	10.8
1976	14,744,324	5,966,816	1,218,732	439,203	7.2
*1981	14,923,280	6,039,331	(178,956)	(72,515)	-1.2
1986	13,953,009	5,646,581	970,271	392,750	6.5

TOTAL AREA LOST = 8,887,889 acres
3,596,902 hectares

PERCENT OF AREA LOST
SINCE 1931 = 38.9

H A L T O N					
YEAR	TOTAL FARM AREA		DECREASE DURING INTERCENSAL PERIOD		
	ACRES	HECTARES	ACRES	HECTARES	PERCENT
1931	217,125	87,868			
1941	215,607	87,254	1,518	614	0.7
1951	204,579	82,791	11,028	4,463	5.1
1956	186,502	75,475	18,077	7,316	8.8
1961	163,277	66,077	23,225	9,399	12.5
1966	153,195	61,996	10,082	4,080	6.2
1971	126,912	51,360	26,283	10,636	17.2
1976	117,866	47,699	9,046	3,661	7.1
*1981	129,030	52,217	(11,164)	(4,518)	-9.5
1986	118,805	48,078	10,225	4,139	7.9

TOTAL AREA LOST = 98,320 acres
39,790 hectares

PERCENT OF AREA LOST
SINCE 1931 = 45.3

*NOTE: Prior to 1981, the figures represent the total number of census farms, whereas, the figures for 1981 and 1986 include both census and commercial farms.

Source: Statistics Canada, Census of Canada.

Table 3.5 The Tenure of Occupied Farms in Ontario and the Region of Halton, from 1931 to 1986.

O N T A R I O									
YEAR	NUMBER OF OCCUPIED FARMS	OWNER		MANAGER		TENANT		PART OWNER/ PART TENANT	
		#	%	#	%	#	%	#	%
1931	192,174	156,678	81.5	749	0.4	21,514	11.2	13,233	6.9
1941	178,204	139,750	78.4	1,629	0.9	21,543	12.1	15,282	8.6
1951	149,920	122,531	81.7	2,628	1.8	8,852	5.9	15,909	10.6
1956	140,602	117,013	83.2	2,437	1.7	6,368	4.5	14,784	10.5
1961	121,333	97,157	80.1	672	0.6	5,610	4.6	17,894	14.7
1966	109,887	85,745	78.0	635	0.6	4,594	4.2	18,913	17.2
1971	75,645	69,862	92.4			4,983	6.6	19,877	26.3
1976	76,983	50,865	66.1			4,403	5.7	21,715	28.2
*1981	82,448	55,206	67.0			4,890	5.9	22,352	27.1
1986	72,713	48,226	66.3			4,244	5.8	20,243	27.8

H A L T O N									
YEAR	NUMBER OF OCCUPIED FARMS	OWNER		MANAGER		TENANT		PART OWNER/ PART TENANT	
		#	%	#	%	#	%	#	%
1931	2,344	1,945	83.0	28	1.2	223	9.5	148	6.3
1941	2,252	1,811	80.4	45	2.0	235	10.4	161	7.1
1951	2,035	1,698	83.4	54	2.7	103	5.1	180	8.8
1956	1,712	1,356	79.2	64	3.7	107	6.3	185	10.8
1961	1,338	953	71.2	14	1.0	131	9.8	240	17.9
1966	1,298	899	69.3	20	1.5	119	9.2	260	20.0
1971	1,108	679	61.3			188	17.0	241	21.8
1976	796	415	52.1			136	17.1	245	30.8
*1981	969	592	61.1			134	13.8	243	25.1
1986	834	530	63.5			102	12.2	202	24.2

NOTE: Prior to 1981, the figures represent the total number of census farms, whereas, the figures for 1981 and 1986 include both census and commercial farms.

Source: Statistics Canada, Census of Canada.

3.5 Servicing Costs

The cost of providing municipal hard services has increased quite dramatically since the 1930's. The following cost estimates for constructing and installing sanitary sewers and water mains were provided by the City of Burlington's Engineering Department:

Table 3.6 The Cost Estimates for Constructing and Installing Sanitary Sewers and Water Mains for the City of Burlington, in 1930, 1954 and 1986.

Year	Sanitary Sewers	Cost	Water Mains	Cost
1930	-		3/4" connection	\$0.10/foot
	-		6 " connection	\$0.65/foot
1954	5" connection	\$10/foot	3/4" connection	\$2/foot
	8" connection	\$11/foot	6 " connection	\$7/foot
1986	125mm connection	\$54/metre	20mm connection	\$ 52/metre
	250mm connection	\$90/metre	150mm connection	\$100/metre

Source: Corporation of the City of Burlington, Engineering Dept.

The costs for 1986 and 1954 are taken from actual contract tenders accepted by the City/Region. The 1930 costs were derived from the 1954 costs. In 1930, there were no sanitary sewers.

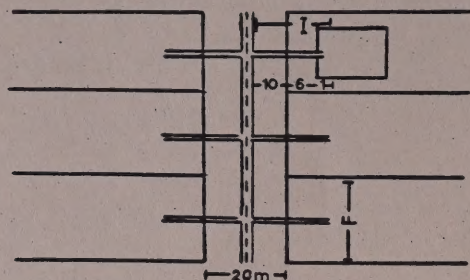
The smaller diameter pipes connect individual homes, while the larger diameter pipes provide the main service. These larger pipes usually run along the centre line of the roads. Not included in these estimates are the capital, operations and maintenance costs of sewage and water treatment plants, or main trunk lines to these facilities.

A comparison of the cost of servicing new communities during the different eras, was analyzed using two different methods. The total cost of servicing a block of six houses, using the average frontage from the subdivision sample (seen in section 4.1), was the first form used. The cost of servicing an individual house was calculated from the resulting figures. The second method compared the cost of servicing an equally sized block of land. The average lot sizes from the subdivisions sampled were used to determined the number of lots per acre.

The functional classification of a local road, according to the Official Plan of the Burlington Planning Area, is to provide access to adjacent land use. The proposed road allowance width is between 14 and 26 metres. An average road width of 20 metres was used in this analysis. The length of the individual connections was an addition of half the road width (10 m), the yard size (6 m) and another metre to allow for the connection into the dwelling.

Although this comparison uses average measurements, and costs would vary slightly more or less, it gives an excellent indication of the intensified economic cost pressures or the increasing marginal cost of development. The cost of constructing and installing water mains for an acre of land rose from \$156.00 in 1930 to \$10,928.94 in 1986. In a block of six houses, the costs

Figure 3.2 Representation of a Block of Six Houses.



Note: Diagram not to scale.

local road = 14-26 metres wide
 yard size = 6 metres in R Zones samples
 connection into house = 1 metre
 individual connection = 17.0 metres
 (I) = 58.8 feet

Table 3.7 The Cost of Servicing a Block of Six Houses, in the City of Burlington, based on the 1930, 1954 and 1986 Cost Estimates.

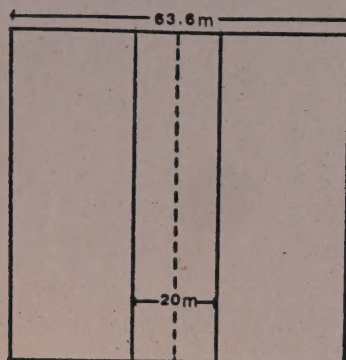
COST OF CONSTRUCTING AND INSTALLING WATER MAINS

	Average Frontage (F)		Length of Main Connection (M = Fx3)		Year	Cost of Main Connection		Length of Individual Connections (Ix6)		Cost of Individual Connections		Total Cost of Servicing Six Houses (\$)	Cost per House (\$)
	(feet)	(metres)	(feet)	(metres)		(\$)	(M x \$)	(feet)	(metres)	(\$)	(Ix6x\$)		
DOWNTOWN	61	19	187	57	1930	0.65/ foot	\$121.55	335	102	0.10/ foot	\$33.50	\$155.05	\$25.8
ALDERSHOT	74	23	226	69	1954	7.00/ foot	\$1,582.00	335	102	2.00/ foot	\$670.00	\$2,252.00	\$375.33
HEADON FOREST	53	16	157	48	1986	100.00/ metre	\$4,800.00	335	102	52.00/ metre	\$5,304.00	\$10,104.00	\$1,684.00

COST OF CONSTRUCTING AND INSTALLING SANITARY SEWERS

	Average Frontage (F)		Length of Main Connection (M = Fx3)		Year	Cost of Main Connection		Length of Individual Connections (Ix6)		Cost of Individual Connections		Total Cost of Servicing Six Houses (\$)	Cost per House (\$)
	(feet)	(metres)	(feet)	(metres)		(\$)	(M x \$)	(feet)	(metres)	(\$)	(Ix6x\$)		
DOWNTOWN	61	19	187	57	1930	-	-	335	102	-	-	-	-
ALDERSHOT	74	23	226	69	1954	11.00/ foot	\$2,486.00	335	102	10.00/ foot	\$3,350.00	\$5,836.00	\$972.67
HEADON FOREST	53	16	157	48	1986	90.00/ metre	\$4,320.00	335	102	54.00/ metre	\$5,508.00	\$9,828.00	\$1,638.00

Figure 3.3 Representation of One Acre of Land.



Note: Diagram not to scale.

acre = 43560.0 square feet
 = 4046.9 square metres
 area of road = 20 metres x $\sqrt{4046.9}$ = 1272.3 square metres
 (R) = 65.6 feet x $\sqrt{43560.0}$ = 13691.4 square feet
 length of main connection = $\sqrt{4046.9}$ = 63.6 metres
 (M) = $\sqrt{43560.0}$ = 208.7 feet
 length of individual connection = 17.0 metres
 (I) = 55.8 feet

Table 3.8 The Cost of Servicing One Acre of Land, in the City of Burlington, based on the 1930, 1954 and 1986 Cost Estimates.

COST OF CONSTRUCTING AND INSTALLING WATER MAINS

	Length of Main Connection (M)		Year	Cost of Main Connection (\$)	Total Cost of Main Connection (M x \$)	Average Lot Size (A)		Number of Lots/Acre [N= (acre-R)/A]	Cost of Individual Connection (\$)	Total Cost of Individual Connections (N x I x \$)	Total Cost of Servicing One Acre
	(feet)	(metres)				(sq. feet)	(sq. metres)				
WINDMILL	208.7	63.6	1930	0.65/foot	\$135.66	8190.37	760.91	3.65	0.10/foot	\$20.35	\$156.00
ALDERSHOT	208.7	63.6	1954	7.00/foot	\$1,460.90	9996.02	928.66	2.99	2.00/foot	\$333.47	\$1,794.37
MEADON FOREST	208.7	63.6	1986	100.00/metre	\$6,360.00	5778.39	536.83	5.17	52.00/metre	\$4,568.94	\$10,928.94

COST OF CONSTRUCTING AND INSTALLING SANITARY SEWERS

	Length of Main Connection (M)		Year	Cost of Main Connection (\$)	Total Cost of Main Connection (M x \$)	Average Lot Size (A)		Number of Lots/Acre [N= (acre-R)/A]	Cost of Individual Connection (\$)	Total Cost of Individual Connections (N x I x \$)	Total Cost of Servicing One Acre
	(feet)	(metres)				(sq. feet)	(sq. metres)				
DOWNTOWN	208.7	63.6	1930	-	-	8190.37	760.91	3.65	-	-	-
ALDERSHOT	208.7	63.6	1954	11.00/foot	\$2,295.70	9996.02	928.66	2.99	10.00/foot	\$1,667.33	\$3,963.03
MEADON FOREST	208.7	63.6	1986	90.00/metre	\$5,724.00	5778.39	536.83	5.17	54.00/metre	\$4,744.67	\$10,468.67

per house rose from \$25.84 in 1930 to \$1,684.00 in 1986. Both of these calculations show an increase greater than 6000 %. In a span of 56 years, this amounts to an increase of more than 100 % per year. The greatest inflation rate during this period was 10.8% per year which occurred between 1980 and 1981 (Statistics Canada, Economic Observer,43).

The cost of supplying sanitary sewers has also risen, but not as dramatically. From 1954 to 1986, the cost of servicing one acre increased \$6,500. In a span of 32 years, this amounts to an increase of approximately \$200.00 per year.

Services, such as water mains and sewers were not always provided by, or expected from the municipalities. Now, the financial cost of supplying such services has become a large portion of the city's budget. Sustainability will require that new developments pay the full cost of installation and maintenance of these services (including treatment plants), as well as others.

This is not the case at present. The observed result is that the increasing marginal cost is increasing the average cost, and therefore the average tax bill. It is a basic economic principle that when both marginal cost and average cost are rising, marginal cost is above average cost, and the size of the organization (City or Region) is structured larger than the economic optimum. That is, the organization is too large, or expansive in its structures and process.

3.5 Motor Vehicle Registrations

The total number of motor vehicle registrations includes passenger automobiles, commercial vehicles and motorcycles. The percentage of the population which has a registered motor vehicle, has increased in Ontario from 16.4% in 1930 to 59% in 1986.

In Halton Region, in 1986, there were 177,958 registered motor vehicles (Ontario Motor Vehicle Licensing Office,1990). This accounted for 66% of Halton's population in 1986 with a registered motor vehicle. It is not only the number of people which own a car which has increased but also the number of cars per household. In Ontario, in 1930, there was an average of 0.76 cars per household which has increased to 1.67 in 1986. The highest rate in Ontario occurred in 1981 when there was an average of 1.85 vehicles per household.

Since the car was introduced in the 1920's, our society has become increasingly dependant upon it. The roads, traffic congestion, parking lots, noise and air pollution are just some of the results produced from our use of the automobile. Present patterns of development and land-use change continue this dependency on the car. This is evident from the local government's demand for completion of the Highway 403 extension.

Table 3.9 The Number of Motor Vehicles in Canada and Ontario, from 1931 to 1986.

C A N A D A					
YEAR	NUMBER OF MOTOR VEHICLE REGISTRATIONS	POPULATION	% OF POP. WITH VEHICLE	NUMBER OF HOUSEHOLDS	AVERAGE VEHICLES/ HOUSEHOLD
1931	1,200,668	10,376,786	11.6		
1936	1,240,124				
1941	1,572,784	11,506,655	13.7	2,706,089	0.58
1946	1,622,463				
1951	2,872,420	14,009,429	20.5	3,409,284	0.84
1956	4,265,437	16,080,791	26.5	3,923,646	1.09
1961	5,517,023	18,238,247	30.2	4,554,736	1.21
1966	7,035,261	20,014,880	35.2	5,180,473	1.36
1971	9,022,136	21,568,311	41.8	6,041,305	1.49
1976	11,786,309	22,992,604	51.3	7,166,095	1.64
1981	13,851,482	24,343,180	56.9	8,281,530	1.67
1986	15,227,311	25,309,330	60.2	8,991,670	1.69

O N T A R I O					
YEAR	NUMBER OF MOTOR VEHICLE REGISTRATIONS	POPULATION	% OF POP. WITH VEHICLE	NUMBER OF HOUSEHOLDS	AVERAGE VEHICLES/ HOUSEHOLD
1931	562,216	3,431,683	16.4		
1941	739,194	3,787,655	19.5	969,267	0.76
1951	1,205,098	4,597,542	26.2	1,181,126	1.02
1956	1,710,240	5,404,933	31.6	1,392,491	1.23
1961	2,126,270	6,236,092	34.1	1,640,881	1.30
1966	2,643,474	6,960,870	38.0	1,876,545	1.41
1971	3,209,862	7,703,106	41.7	2,228,160	1.44
1976	4,102,344	8,264,465	49.6	2,634,620	1.56
1981	5,507,801	8,625,110	63.9	2,969,785	1.85
1986	5,367,277	9,101,695	59.0	3,221,730	1.67

Source: Statistics Canada, Census of Canada.

3.7 Commuters

Work and home were not always separated. With the rise of the industrial era and the availability of the automobile, work and home began to be two distinct places. Zoning legislation further isolated industrial, commercial and residential areas from each other.

Low density, quiet "suburbs" quickly sprawled as city centres became noisy and congested. Urban transportation then became a major concern. Mass transit systems and super highways were built in order to accommodate this rush of movement into the city during the morning and out of the city at night.

Burlington is an excellent example of such "bedroom communities" which have been created. Its transportation system has become quite extensive since the first paved roads in 1918. The first section of the Queen Elizabeth Way (QEW) was completed in 1939, which by 1960 was a completely controlled access highway that connected Toronto to Fort Erie. A complex road network of over seven provincial highways and the new Skyway Bridge existed in Burlington by 1958.

The number of commuters in Burlington has increased substantially. There has also been a shift in the areas to where they are commuting. Tables 3.7 and 3.8 show the number of commuters to and from Burlington in 1971 and 1986, respectively. It is necessary to note that the figures from 1971 represent the number of car trips, whereas the 1986 figures represent the total number of people commuting. If the assumption is made that there is only one person per car (which is probably not too much in error), these numbers are comparable. The percentages, rather than the actual numbers are more accurate.

Table 3.10 The Number of Commuters in the City of Burlington, in 1971.

TO BURLINGTON FROM:			FROM BURLINGTON TO:		
	CAR TRIPS NO.	%		CAR TRIPS NO.	%
Hamilton-Wentworth	3,830	84.6	Hamilton-Wentworth	10315	59.6
Within Halton (but outside Burlington)	435	9.6	With Halton (but excluding Burlington)	3850	22.2
East of Halton	255	5.6	East of Halton	3145	18.2
TOTAL	4,526	100%	TOTAL	17310	100%

Source: Statistics Canada, Census of Canada.

Table 3.11 The Number of Commuters in the City of Burlington, in 1986.

TO BURLINGTON FROM:			FROM BURLINGTON TO:		
	WORK TRIPS NO.	%		WORK TRIPS NO.	%
Hamilton-Wentworth	9,400	76.4	Hamilton-Wentworth	6,700	33.7
North Halton and North Peel	500	4.1	North Halton and North Peel	1,000	5.0
Metro and Peel	2,400	19.5	Metro and Peel	12,200	61.3
TOTAL	12,300	100%	TOTAL	19,900	100%

Source: Province of Ontario, Transportation Tomorrow Survey.

In 1971, there was a total of 4,526 car trips into Burlington. The largest percentage, 86%, came from Hamilton-Wentworth. At the same time, there were 17,310 car trips out of Burlington. The largest percentage, 59.6%, were travelling to Hamilton-Wentworth. Only 18.2% of the car trips out of Burlington, in 1971, were headed east of Halton.

In 1986, there was a total of 12,300 work trips into Burlington. The largest percentage, 76.4, was still from Hamilton-Wentworth. During the same time, there were 19,900 work trips out of Burlington. This accounts for 29% of the 66,700 people in the labour force (15 years and over) in Burlington, in 1986 (Statistics Canada, Census of Canada, 1986). The greatest percentage of commuters out of Burlington, 61.3%, is now travelling towards Metro and Peel. This does not include the Go Train users, which accounted for 1072 commuters in 1987 (Go Transit, 1989, from a Corporation of the City of Burlington, Background Report Official Planning Review).

3.7 Development Approvals

The number of registered subdivisions in the City of Burlington and Planning Area is another means of showing the growth of the area. These numbers were obtained by an actual count of the approvals according to their registration dates.

These figures are just a general outline of the growth, since the area, and number of lots within each subdivision varies significantly. In most cases, the older approvals were for smaller areas and fewer lots, and the more recent approvals usually involve much larger tracts of land.

A continuation of the expansion and growth is very evident from the number of the approvals. The loss of farmland, traffic congestion, roads and other effects of urban sprawl, like increasing taxes, are directly related to this development.

Table 3.12 The Number of Registered Subdivisions in the City of Burlington and Planning Area, from 1930 to 1986.

Time Period	Number of Approvals
1930-1939	7
1940-1949	24
1950-1959	118
1960-1969	111
1970-1979	117
1980-1989	102

Source: City of Burlington, Planning Department.

4. SPECIFIC COMMUNITY CHARACTERISTICS

4.1 House and Lot Size Characteristics

A random sample of thirty single-family detached dwellings was taken for three areas in the City of Burlington that are characteristic of the three eras of distinct growth; the Downtown area, Aldershot and Headon Forest. The purpose of this procedure was to compare various features of the houses, the lots and the neighbourhoods as a whole. All samples are within single family residential zones, (R ZONE), except for a few in the Downtown sample which are in transitional zones, (T/RM). These would have been residential areas during the period after they were built. Regulations and uses for the R Zone classifications are provided in the Appendix.

The dwellings sampled in the Downtown area were built prior to 1949. The Aldershot sample consists of houses built between 1950 and 1969, and in Headon Forest the years 1970-1989 are represented.

The Lot Area is a measure of the frontage (lot width) by the depth. The Downtown sample has an average lot area of 761 square metres (0.19 acres), which increases to 929 square metres (0.23 acres) in the Aldershot sample. In the newest community, the average lot area is reduced to 537 square metres (0.13 acres).

Another noticeable distinction between these subdivisions is the range of the samples. The maximum and minimum values of the frontage, depth and lot area cover a much wider range in the downtown area. This is reduced somewhat in Aldershot, and substantially reduced in Headon Forest. The standard deviation measures the spread of the data about the mean and is indicative of a greater diversity of form and values, among other things. A short walk in each of these areas shows this clearly to the eye.

Gross Floor Area is a measure of the area of the structure not including basement area. Although Headon Forest has the smallest average lot size, the dwellings in this sample were the largest in average Floor Area. The average Floor Area of 140 square metres (1507 square feet) in the Downtown increased slightly to 146 square metres (1568 square feet) in Aldershot and then jumped to 199 square metres (2146 square feet) in Headon Forest.

The number of storeys is defined as the number of parts into which a house is divided horizontally. The Downtown Sample consists of a variety of full and part storeys. The Aldershot Sample consists of some two story houses, a few half storeys, but the majority of houses (60%) are Bungalows (one story). The overwhelming majority (90%) of the Headon Forest Sample are houses with two full storeys. As with the range of lot sizes, the range

and the variety of house types, and therefore the diversity, is reduced quite significantly within Headdon Forest.

Lot Coverage is the percent of the lot which is covered by the structure, and is measured by using the following formula;

$$\text{LOT COVERAGE} = \frac{(\text{Gross Floor Area} / \# \text{ of Storeys})}{\text{Lot Areas}} \times 100$$

In order to obtain the most accurate measure of lot coverage, houses with split levels were not used in the samples.

Since the houses in Headdon Forest are, on average, the largest homes on the smallest lots, it is not surprising that the average percent of the lot covered by the structure is also the highest. The average lot coverage in the Downtown area is 12.4%, in Aldershot 12.8% and in Headdon Forest 21.2%. The maximum coverage of 21.8% in Aldershot is increased to 41.1% in Headdon Forest.

The type and number of garages is another feature which is unique to each of these communities. The Downtown area had an average of one garage per house. Within this sample there is 27% with parking (no garage), 57% with detached garages and 17% with attached garages. Only three of the thirty houses sampled had a two car garage and these were all detached.

Aldershot also has an average of one garage per house. There were 7% in the sample with parking, 10% with a carport, 7% with a detached garage and the majority, 77%, with an attached garage. Only six of the thirty sampled had a two car garage.

Within Headdon Forest there is, again, not as much variation. Two of the thirty houses sampled or 7% had a carport, the remaining 93% had attached garages. Twenty-six of the thirty sampled had a two car garage.

Comparison of these three communities reveals a number of trends and characteristics which are unique to the eras in which they were built. Single family dwellings prior to 1949 often did not provide any shelter for their automobiles. If there was a garage it was usually detached. A much greater variety of house shapes and lots sizes existed in this era.

During the post war era, it became common to incorporate a one car garage into the design of the dwelling. Lot sizes increased but the average size of the structure did not.

With inflating prices, scarcity of suitable land, and the driving factor of continuing population growth, the lot sizes in the newest neighbourhoods have been reduced significantly.

Table 4.1 House and Lot Size Sample in the Downtown Area of the City of Burlington.

DESCRIPTION:				YEAR BUILT	FRONTAGE		DEPTH		LOT AREA		GROSS FLOOR AREA (square (square feet) metres)		# OF STOREYS	% LOT COVERAGE	GARAGE TYPE	#
#	PLAN	LOT	ZONE		(feet)	(metres)	(feet)	(metres)	(acres)	(sq.metres)	feet)	metres)				
1	M315	57	R3.10	1949	75.00	22.86	120.00	36.58	0.21	836.13	1748	162.4	1.50	12.9	detached	1
2	M117	61	R3.10	1910	49.00	14.94	124.00	37.80	0.14	564.48	1540	143.1	2.50	10.1	detached	1
3	M144	pt40,41	R3.10	1939	65.00	19.81	147.00	44.81	0.22	887.69	1737	161.4	1.75	10.4	parking	-
4	M169	pt36,37	R2	1919	41.00	12.50	132.00	40.23	0.12	502.79	1112	103.3	1.50	13.7	detached	2
5	M92	pt9	R3.10	1910	44.00	13.41	165.00	50.29	0.17	674.48	1978	183.8	2.50	10.9	parking	-
6	M117	101,102	R3.10	1917	70.00	21.34	124.00	37.80	0.20	806.40	2284	212.2	2.50	10.5	detached	2
7	M85	5	R3.10	1931	50.00	15.24	233.00	71.02	0.27	1082.32	1992	185.1	2.00	8.5	attached	1
8	M90	10	R3.10	1895	52.00	15.85	130.00	39.62	0.16	628.02	1122	104.2	1.25	13.3	parking	-
9	M117	22,23	R3.10	1890	38.00	11.58	70.00	21.34	0.06	247.12	1162	108.0	1.25	34.9	parking	-
10	M117	32	R3.10	1949	35.00	10.67	114.00	34.75	0.09	370.68	935	86.9	1.25	18.7	parking	-
11	M113	pt11,12	R1	1947	126.00	38.40					2002	186.0	2.50		attached	1
12	M220	34	R1	1935	64.00	19.51	115.00	35.05	0.17	683.77	2141	198.9	2.75	10.6	attached	1
13	M220	4	R1	1949	95.00	28.96	140.00	42.67	0.31	1235.61	2509	233.1	1.75	10.8	attached	1
14	M146	21,22	R2	1939	100.00	30.48	150.00	45.72	0.34	1393.55	1685	156.5	1.75	6.4	detached	1
15	M 92	con92	R3.10	1945	53.00	16.15	120.00	36.58	0.15	590.86	885	82.2	1.00	13.9	detached	1
16	M196	pt50,49	R3.10	1944	85.00	25.91	267.00	81.38	0.52	2108.43	2129	197.8	1.00	9.4	detached	1
17	M134	23	R3.10	1942	45.00	13.72	108.00	32.92	0.11	451.51	756	70.2	1.00	15.6	parking	-
18	M196	38	R3.10	1939	53.74	16.38	124.97	38.09	0.15	623.93	699	64.9	1.50	6.9	detached	1
19	M209	pt12	R3.10	1940	62.00	18.90	158.00	48.16	0.22	910.08	1449	134.6	1.50	9.9	attached	1
20	M209	pt185-6	R3.10	1945	75.00	22.86	105.00	32.00	0.18	731.61	991	92.1	1.75	7.2	detached	1
21	M356	151	R3.10	1949	50.00	15.24	120.00	36.58	0.14	557.42	1325	123.1	1.50	14.7	detached	1
22	M65	pt22...	T/RM6	1925	50.00	15.24	210.00	64.01	0.24	975.48	1239	115.1	2.00	5.9	detached	2
23	M 74	pt13,14	T/RM6	1937	52.00	15.85	160.00	48.77	0.19	772.95	1641	152.5	1.25	15.8	detached	1
24	M74	pt20	T/RM6	1914	65.00	19.81	154.00	46.94	0.23	929.96	2205	204.9	1.75	12.6	parking	-
25	M212	11		1925	43.00	13.11	128.00	39.01	0.13	511.34	1758	163.3	2.25	14.2	detached	1
26	M535	1	R3.10	1925	70.00	21.34					1433	133.1	1.75		detached	1
27	M 45	2	R3.10	1914	66.00	20.12	132.00	40.23	0.20	809.37	1104	102.6	1.50	8.4	detached	1
28	M145	173	R3.10	1939	40.00	12.19	137.00	41.76	0.13	509.11	1112	103.3	1.75	11.6	detached	1
29	M117	pt52,53	R3.10	1922	50.00	15.24	70.00	21.34	0.08	325.16	1144	106.3	1.50	21.8	detached	1
30	M117	910	R3.10	1925	70.00	21.34	90.00	27.43	0.14	585.29	1402	130.3	2.50	8.9	parking	-
average:					61.12	18.63	137.43	41.89	0.19	760.91	1507	140.0		12.5		1
maximum:					126.00	38.40	267.00	81.38	0.52	2108.43	2509	233.1		34.9		0
minimum:					35.00	10.67	70.00	21.34	0.06	247.12	699	64.9		5.9		2
standard deviation:					20.00	6.10	41.98	12.80	0.09	366.08	483	44.9		5.6		

Source: Corporation of the City of Burlington, 1990 Municipal Property Assessment.

Table 4.2 House and Lot Size Sample in the Aldershot Community of the City of Burlington.

DESCRIPTION:			YEAR BUILT	FRONTAGE		DEPTH		LOT AREA		GROSS FLOOR AREA		# OF STOREYS	% LOT COVERAGE	GARAGE		
#	PLAN	LOT		ZONE	(feet)	(metres)	(feet)	(metres)	(acres)	(sq.metres)	(square feet)			(square metres)	TYPE	#
1	M758	33	R2.3	1952	100.00	30.48	200.00	60.96	0.46	1858.06	1587	147.4	1.00	7.9	attached	1
2	M791	58	R2.3	1953	75.00	22.86	107.00	32.61	0.18	745.55	1250	116.1	2.00	7.8	attached	1
3	M 93	2	R2.3	1975	60.00	18.29	128.75	39.24	0.18	717.68	2308	214.4	2.00	14.9	attached	2
4	M629	18,19	R2.3	1963	64.37	19.62	146.01	44.50	0.22	873.16	1888	175.4	1.00	20.1	attached	2
5	M834	pt3	R2.3	1953	80.00	24.38	156.00	47.55	0.29	1159.43	1872	173.9	1.00	15.0	carport	1
6	M629	pt39,40	R2.3	1957	70.00	21.34	183.00	55.78	0.29	1190.09	1809	168.1	1.00	14.1	attached	1
7	M732	pt154	R2.3	1950	65.00	19.81	148.23	45.18	0.22	895.12	1530	142.1	1.00	15.9	attached	1
8	M1006	58	R2.3	1956	60.00	18.29	125.00	38.10	0.17	696.77	1213	112.7	2.00	8.1	attached	1
9	M887	7	R2.3	1954	63.00	19.20	124.92	38.08	0.18	731.14	1439	133.7	1.00	18.3	parking	-
10	M873	3	R2.3	1956	68.00	20.73	110.00	33.53	0.17	694.91	1199	111.4	2.00	8.0	attached	1
11	M873	173	R2.3	1957	88.00	26.82	100.00	30.48	0.20	817.55	1429	132.8	1.00	16.2	attached	1
12	M1093	32	R2.3	1957	75.00	22.86	140.00	42.67	0.24	975.48	1288	119.7	1.00	12.3	attached	2
13	M663	32	R3.11	1958	50.00	15.24	223.00	67.97	0.26	1035.87	1163	108.0	1.50	7.0	detached	1
14	M825	68	R2.3	1952	90.00	27.43	141.00	42.98	0.29	1178.94	1826	169.6	1.50	9.6	attached	1
15	M1297	6	R2.4	1966	64.50	19.66	116.00	35.36	0.17	695.10	2107	195.7	2.50	11.3	attached	2
16	M1137	4	R2.3	1960	75.00	22.86	162.00	49.38	0.28	1128.77	1812	168.3	2.50	6.0	attached	1
17	M732	44,45	R2.3	1952	65.00	19.81	150.00	45.72	0.22	905.80	1775	164.9	1.00	18.2	carport	1
18	M950	18	R2.3	1957	113.00	34.44	120.00	36.58	0.31	1259.77	4423	410.9	1.50	21.7	carport	1
19	M873	124	R2.3	1954	65.00	19.81	120.00	36.58	0.18	724.64	1349	125.3	1.50	11.5	attached	1
20	M873	44	R2.3	1955	68.00	20.73	110.00	33.53	0.17	694.91	1292	120.0	1.50	11.5	attached	1
21	M942	2	R2.3	1952	65.00	19.81	105.00	32.00	0.16	634.06	1192	110.7	1.50	11.6	attached	1
22	M844	1	R2.3	1958	57.00	17.37	220.00	67.06	0.29	1165.00	1587	147.4	1.00	12.7	built-in	2
23	M118	30	R2.3	1951	80.00	24.38	106.00	32.31	0.19	787.82	905	84.1	1.00	10.7	attached	1
24	M118	19	R2.3	1956	81.00	24.69	120.00	36.58	0.22	903.02	1496	139.0	1.00	15.4	attached	1
25	M858	20	R2.3	1962	90.00	27.43	125.00	38.10	0.26	1045.16	1363	126.6	1.00	12.1	attached	2
26	M629	pt36,35	R2.3	1958	67.00	20.42	134.00	40.84	0.21	834.08	1258	116.9	1.00	14.0	attached	1
27	M1006	22	R2.3	1955	60.00	18.29	125.00	38.10	0.17	696.77	1223	113.6	1.00	16.3	parking	-
28	conBF	pt4	R2.3	1952	100.00	30.48	120.00	36.58	0.28	1114.84	945	87.8	1.00	7.9	detached	1
29	M873	114	R2.3	1956	100.00	30.48	108.00	32.92	0.25	1003.35	1474	136.9	1.00	13.6	attached	1
30	M873	265	R2.3	1953	61.00	18.59	123.00	37.49	0.17	697.05	1061	98.6	1.00	14.1	attached	1
average:					74.00	22.55	136.56	41.62	0.23	928.66	1569	145.7		12.8		1
maximum:					113.00	34.44	223.00	67.97	0.46	1858.06	4423	410.9		21.7		2
minimum:					50.00	15.24	100.00	30.48	0.16	634.06	905	84.1		6.0		0
standard deviation:					15.02	4.58	32.02	9.76	0.06	254.17	624	58.0		4.0		

Source: Corporation of the City of Burlington, 1990 Municipal Property Assessment.

Table 4.3 House and Lot Size Sample in the Headon Forest Community of the City of Burlington.

#	DESCRIPTION:		YEAR BUILT	FRONTAGE		DEPTH		LOT AREA		GROSS FLOOR AREA		# OF STOREYS	% LOT COVERAGE	GARAGE	
	PLAN	LOT		(feet)	(metres)	(feet)	(metres)	(acres)	(sq.metres)	(square feet)	(square metres)			TYPE	#
1	M 48	62	R3.6	1971	47.69	14.54	100.00	30.48	0.11	443.05	1221	113.4	1.00	carport	1
2	M 87	84	R3.6	1974	50.00	15.24	101.00	30.78	0.12	469.16	2074	192.7	1.00	attached	2
3	M323	148	R3.8	1985	60.04	18.30	100.06	30.50	0.14	558.12	2479	230.3	2.00	attached	2
4	M366	55	R3.8	1986	50.85	15.50	100.07	30.50	0.12	472.74	2081	193.3	2.00	attached	2
5	M420	57	R3.8	1988	62.99	19.20	152.95	46.62	0.22	895.06	2911	270.4	2.00	attached	2
6	M458	137	R3.6	1988	47.64	14.52	104.99	32.00	0.11	464.68	2336	217.0	2.00	attached	2
7	M441	145	R3.8	1988	50.00	15.24	101.20	30.85	0.12	470.09	2038	189.3	2.00	attached	2
8	M339	129	R3.6	1985	49.87	15.20	109.91	33.50	0.13	509.22	2547	236.6	2.00	attached	2
9	M323	114	R3.8	1985	43.54	13.27	141.04	42.99	0.14	570.51	2569	238.7	2.00	attached	2
10	M 48	46	R3.6	1971	50.00	15.24	100.00	30.48	0.11	464.52	1177	109.3	1.00	carport	1
11	M441	154	R3.8	1988	50.00	15.24	100.98	30.78	0.12	469.07	1716	159.4	2.00	attached	2
12	M419	191	R3.8	1987	53.19	16.21	100.36	30.59	0.12	495.93	2231	207.3	2.00	attached	2
13	M324	21	R3.6	1985	45.80	13.96	121.59	37.06	0.13	517.36	2021	187.8	2.00	attached	2
14	M324	51	R3.8	1985	45.11	13.75	100.07	30.50	0.10	419.38	1757	163.2	2.00	attached	2
15	M306	43	R3.8	1985	60.04	18.30	100.06	30.50	0.14	558.12	2674	248.4	2.00	attached	2
16	M441	167	R3.8	1984	60.04	18.30	100.06	30.50	0.14	558.12	2639	245.2	2.00	attached	2
17	M441	63	R3.8	1988	50.00	15.24	100.30	30.57	0.12	465.91	1920	178.4	2.00	attached	2
18	M365	59	R3.8	1986	32.23	9.82	93.27	28.43	0.07	279.28	2365	219.7	2.00	attached	2
19	M420	9	R3.8	1987	50.00	15.24	100.70	30.69	0.12	467.77	2388	221.9	2.00	attached	2
20	M419	194	R3.8	1987	50.30	15.33	100.52	30.64	0.12	469.73	2206	204.9	2.00	attached	2
21	M339	77	R3.6	1986	48.72	14.85	113.19	34.50	0.13	512.32	2774	257.7	2.00	attached	2
22	M305	54	R3.8	1984	45.66	13.92	88.12	26.86	0.09	373.80	1824	169.5	2.00	attached	2
23	M307	74	R3.6	1984	60.62	18.48	100.06	30.50	0.14	563.52	2320	215.5	2.00	attached	2
24	M307	30	R3.6	1984	78.48	23.92	128.08	39.04	0.23	933.84	2128	197.7	2.00	attached	3
25	M426	191	R3.54	1988	44.39	13.53	104.99	32.00	0.11	432.98	1455	135.2	2.00	attached	2
26	M426	77	R3.6	1988	49.87	15.20	104.99	32.00	0.12	486.43	2018	187.5	2.00	attached	2
27	M458	43	R3.6	1988	56.66	17.27	101.31	30.88	0.13	533.28	2541	236.1	2.00	attached	2
28	M366	95	R3.8	1986	45.47	13.86	117.65	35.86	0.12	496.99	2034	189.0	2.00	attached	2
29	M307	8	R3.6	1984	83.59	25.48	153.41	46.76	0.29	1191.35	2089	194.1	2.00	attached	2
30	M378	31	R3.8	1987	60.53	18.45	100.06	30.50	0.14	562.68	1852	172.1	2.00	attached	1
average:					52.78	16.09	108.03	32.93	0.13	536.83	2146	199.4			2
maximum:					83.59	25.48	153.41	46.76	0.29	1191.35	2911	270.4			3
minimum:					32.23	9.82	88.12	26.86	0.07	279.28	1177	109.3			1
standard deviation:					9.90	3.02	15.82	4.82	0.04	172.68	417	38.7			6.4

Source: Corporation of the City of Burlington, 1990 Municipal Property Assessment.

Although lot size has decreased, the house size has increased. Most houses are built with two full storeys as well as an attached two car garage, usually built in the front.

The character and structural design of a subdivision has an enormous effect on the community atmosphere and the quality of life within it. Humanity has the ability to both shape and be shaped by their environment (Corbett, 1981). Our new neighbourhoods are designed with more concern for cars and mobility than for community. There is a lack of diversity and no integration with the natural environment. Sustainability will require alternative community and land use patterns.

Table 4.4 A Comparison of the Downtown, Aldershot and Headon Forest Sample Results.

		FRONTAGE		DEPTH		LOT AREA		GROSS FLOOR AREA		% LOT COVERAGE	# OF GARAGES
		(feet)	(metres)	(feet)	(metres)	(square feet)	(square metres)	(square feet)	(square metres)		
AVERAGE:	D	61.12	18.63	137.43	41.89	0.19	760.91	1507	140.00	12.4	1
	A	74.00	22.55	136.56	41.62	0.23	928.66	1568	145.74	12.8	1
	H	52.78	16.09	108.03	32.93	0.13	536.83	2146	199.40	21.2	2
MAXIMUM:	D	126.00	38.40	267.00	81.38	0.52	2108.43	2509	233.10	35.0	2
	A	113.00	34.44	223.00	67.97	0.46	1858.06	4423	410.91	21.8	2
	H	83.59	25.48	153.41	46.76	0.29	1191.35	2911	270.40	41.1	3
MINIMUM:	D	35.00	10.67	70.00	21.34	0.06	247.12	699	64.90	5.9	0
	A	50.00	15.24	100.00	30.48	0.16	634.06	905	84.08	6.0	0
	H	32.23	9.82	88.12	26.86	0.07	279.28	1177	109.30	8.1	1
STANDARD DEVIATION:	D	20.00	6.10	41.98	12.80	0.09	366.08	483	44.90	5.6	
	A	15.02	4.58	32.02	9.76	0.06	254.17	624	57.96	4.0	
	H	9.90	3.02	15.82	4.82	0.04	172.68	417	38.72	6.4	

NOTE: D=Downtown
A=Aldershot
H=Headon Forest

Source: Tables 4.1, 4.2, 4.3.

4.2 Road Coverage

The area covered by roads was compared between the subdivisions of Headon Forest, Aldershot and the Downtown area. Four samples measuring the length of the road in a one hundred acre area were taken in each of these subdivisions. The City of Burlington Municipal Address Maps, with a scale of 1 cm to 50 metres, were used as the base for measuring.

The average length of the four samples was then multiplied by the road width in order to obtain the complete area covered. An

average road width of 20 metres was used in each calculation. The area covered per acre was obtained by dividing by 100, and the percent of acre covered was a division by 4048.3 (4048.3 square metres in an acre).

The downtown area had the largest percent, 28.6% of an acre covered by roads. This high percent is partly a result of the grid pattern used in this area, but it might also reflect changes in road widths made more recently. 22.1% of an acre in Aldershot is taken up by roads. Larger lots and a winding road pattern, among other things, lead to a smaller area covered by roads.

In Headon Forest, the same type of winding road pattern is used but since the lots are smaller, a greater area of roads is required to service the homes. There is a road coverage of 26.1% in Headon Forest.

The road pattern and lot sizes are two factors which contribute to varying road coverages. Parking lots, driveways and other paved surfaces needed to accommodate the automobile are in addition to these calculations. Although this sample disregards other such features and varying road widths, it gives an excellent indication of the vast amount of land which is used for roads.

Table 4.5 A Comparison of the Road Coverage in Downtown, Aldershot and Headon Forest Communities.

		String Length in 100 acre area (cm)	Average Length (cm)	Actual Length (m) (1cm=50m)	Total Area Covered by Roads (m ²)	Area/Acre Covered by Roads (m ²)	Percent of Acre Covered by Roads
DOWNTOWN	1	108.2					
	2	117.3	115.6	5781.3	115625.0	1156.3	28.6
	3	112.5					
	4	124.5					
ALDERSHOT	1	95.8					
	2	73.2	89.5	4475.0	89500.0	895.0	22.1
	3	99.5					
	4	89.5					
HEADON FOREST	1	94.9					
	2	102.5	105.8	5292.5	105850.0	1058.5	26.1
	3	110.5					
	4	115.5					

Source: Corporation of the City of Burlington, Municipal Address Maps #2, 3, 4A, 5 and 11.

4.3 Community Atmosphere

The idea of sustainable development not only implies wisdom and stewardship in resource management for the future, but also includes fulfilment of basic human needs-food, shelter, clothing and the economic means through which to achieve these (Donaldson,1990). Quality of life is another factor involved.

The concept of community is believed to be the oldest human institution. According to Kirkpatrick Sale, "the human need and capacity for communality is genetically encoded..." (Sale,1980,180). The social dynamics of the community in which we live are a vital aspect of our daily lives. Their presence, or lack of presence, influences our relationships, attitudes, behaviours, and ultimately the overall quality of life.

Features such as proximity to schools and services, common space, and house and lot characteristics within a neighbourhood create different community atmospheres. It is quite subjective whether one atmosphere creates a better quality of life or not, since quality of life is based on each individual's expectations and perceptions. Although quality of life is difficult to measure, because of its importance, it needs to be included.

It can also be argued that quality of life is more perceptible due to things that detract from it, or by its absence, rather than by any concretely measurable factor. This may be illustrated by the list of facilities in Table 4.6. Even though the size of the areas vary, it gives a good indication of the available features which contribute to each community.

Since the Downtown area is now also the core of the city, there are a wider range of services available. Aldershot, as well, consists of an assortment of features. Heaton Forest has the fewest facilities. So far, there are no schools at all within this community, so residents of Heaton Forest rely on schools in the surrounding area.

The proximity of services like schools, influences the behaviour of the members in the community. When schools are located within the neighbourhood, in reasonable walking distance, children usually walk to and from classes. The time spent travelling can be full of unstructured interaction (unlike in the classroom) with neighbourhood peers. The school itself and the surrounding playground become an integral focus of the community. Children feel part of a distinct school community and can identify themselves within it. The schools in Aldershot would likely create such an atmosphere.

Table 4.6 A Comparison of the Facilities in the Downtown, Aldershot and Headon Forest Communities.

Bounded by;	<u>DOWNTOWN</u>	<u>ALDERSHOT</u>	<u>HEADON FOREST</u>
North	Prospect St.	Plains Rd.	Highway #5
South	L.Ontario	Burlington Bay	Upper Middle
East	Guelph Line	QEW	Walkers Line
West	QEW	Holy Sepulchre Cemetery	Guelph Line
Elementary School	x	x	
Secondary School	x	x	
Separate School	x	x	
Place of Worship	x	x	x
Shopping Centre	x	x	x
Park	x	x	x
Community Centre	x	x	x
Community Centre with an indoor pool	x	x	
Arena	x	x	
Golf Course		x	
Senior Citizen's Home	x		
Museum	x		
Cultural Centre	x		
Police Station	x		
Hospital	x		
Cemetery		x	
Bikeway	x		

Source: City of Burlington, Road Map.

If schools are not located within walking distance, parents will drive their children to school if buses are not available. This probably occurs quite often in Headon Forest. Inside a car, the unstructured interaction with peers is limited, and may also reduce connections with the neighbourhood. When a school is "outside" of a community, the association of the school community with the neighbourhood community is also lost. A general statement could be made that when people feel part of something, they are more concerned about it.

A similar comparison can be made with shopping facilities. If shopping is available within the community, modes of transportation other than driving, such as biking and walking could be used to get there. As well, small scale, local shops create a unique community identity. Customers are better able to interact with a familiar face, and are also supporting a local economy. A small corner store or an area such as Village Square in downtown Burlington are examples of small scale local shops.

If shopping facilities are completely separated from the residential community, a car or public transit is usually necessary. This separation as well as an increase in structure size has been the trend over the past years. Large scale climate controlled malls or strip malls are now very common.

The SuperCentre on the corner of Upper Middle road and Guelph Line is an excellent example. A vast parking lot is necessary with this type of shopping facility. Most of the shops within these malls are large chains, which have no unique community flavour, and do not support a local economy. Present new developments, like the Maple Street Mall, are continuing this trend of large scale, indoor shopping facilities which cater to and require the use of a car.

An area within a community which is not owned by one particular person, and is available for use by all, is referred to as common space. A common space can be provided in a number of forms such as parks, community centres, school yards, bike paths or natural, open space. It is also possible that community gardens for food production could be incorporated. A diverse and productive range of common space is necessary to fulfil the needs of all the various members of the community.

Each of the three communities in Burlington has been provided with parks, community centres, school yards and other structured facilities. Community centres provide classes, programs, swimming pools, gymnasiums, and meeting places. Parks are filled with ball diamonds, football fields, and manicured green space. These facilities are all very important, but opportunity for passive use of natural undisturbed areas has been neglected. It is known that there is a definite "need for sacred places, places where one can go to commune with nature, to experience natural cycles and to escape the hyperactivity of city life" (Donaldson, 1990).

Various house and lot characteristics also have a subtle influence on community life. Since individual houses are situated closer together when lot sizes are smaller and houses become bigger (as in Headon Forest), the amount of privacy is reduced. Backyards become smaller and lose many of their functional abilities. Recreational activities such as baseball or even just "catch" are almost impossible. When recreational opportunities are reduced, residents look elsewhere for facilities, creating a greater demand and need for parks. A large outflow of people during weekends is an addition symptom.

Another feature of houses which has evolved over the years is the porch. In older communities such as the Downtown area, most houses have large porches at the front of the house. Community interaction is thus focused towards the front of the neighbourhood or the street, which is common ground. A familiar and welcoming atmosphere within the neighbourhood is created. This acts as an integrating factor, an important aspect of sustainability.

The newer communities put less emphasis on the large front porch. The porch has decreased in size so it is no longer useful as a meeting place (Theisz, 1987). The outward focus towards the street is consequently reduced somewhat. The most recent communities, like Headon Forest, have further reduced the front porch. It is now rarely part of the structure at all. Interaction within the neighbourhood is reduced significantly. Large decks at the back of the house are now quite common. Individual and commonly fenced backyards, together with a lack of common space, create little opportunity for neighbourhood contact. The design and the planning of many seemingly insignificant features, such as a porch, unconsciously affect the quality of life within a community.

5. PRINCIPLES/GUIDELINES WHICH WOULD INCREASE SUSTAINABILITY

5.1 General Principles

The possibilities of sustainable development require alterations in numerous areas of governmental policies, resource use and individual consumptive habits. The previous sections have shown numerically that our demand for resources has increased enormously, and both the total costs and the marginal costs associated with providing such services have also risen substantially. It is clear that alternative practices must be considered.

A redirection of our attitudes and our knowledge could ensure more efficient and sustainable use of the resources we share, as well as reducing future impacts on the environment. A quality of life, both human life and the life of the environment, would be protected and possibly improved.

The following principles are examples that sum up environmentally sustainable development. These integrate social and environmental considerations into all facets of decision making;

1. policies should be based on anticipation and prevention rather than reaction and cure.
2. policies/programmes/projects should be based on a philosophical shift in decision making, at the bureaucratic, political and individual level.
3. policies/programmes/projects should aim for net environmental gain.
4. policies/programmes/projects should promote and adopt environment-economy integration.
5. policies/programmes/projects should ensure equitable distribution (Donaldson, 1989, 5).

Similar principles have been adopted by the Ontario Roundtable on Economy and Environment. These are;

1. Anticipate and prevent
2. Informed decision making
3. Full cost accounting (What we buy doesn't reflect the full cost)
4. Living off the interest (doing better for less)
5. Quality over quantity
6. Respect for nature and the rights of future generations (Ontario Roundtable, 1989).

More specific guidelines, relating to the various indicators of sustainability, adopt and apply these general principles. These suggestions focus at a municipal government planning level, and deal with problems for both short and long term perspectives. Technological fixes may bring about what are thought to be immediate solutions, but changes in attitudes and lifestyles are necessary to reduce cumulative future impacts. What has often been found is that technology can create more problems than it solves.

5.2 Energy Efficiencies

Canada's use of energy is twice as much per capita as Japan or Sweden (Suzuki,1990). The statistics from Ontario Hydro show similar consumptive rates in Ontario. Local governments can help reduce this pattern by providing housing structures with the most up-to-date energy efficient features as well as encouraging and promoting renewable energy sources. Small-scale localized energy sources would be the ideal.

1. **Ensure building structures utilize the most energy efficient technologies.** Use of new low energy light bulbs could become part of mandatory building codes. These compact fluorescent lamps are designed to replace incandescent lamps by providing equivalent light output at a fraction of the wattage. It has been shown that a 9 watt compact fluorescent replacing a 40 watt incandescent in a home (over the lamp lifetime of 10,000 hours), has an energy savings of 310 kWh of electricity and a dollar savings of \$6.55 (Ontario Roundtable,1990). It also reduces carbon emissions and other pollutants.

Insulation in a building structure has an enormous influence on energy savings. An R2000 home is now considered a performance standard for energy efficient homes. However, despite the need to move towards sustainability, there is little motivation shown by the house building industry in general, to utilize this technology. An R2000 level of insulation is much greater than any building code requires and its construction costs are somewhat higher, even though the houses are more cost-effective (Ontario Hydro,1989).

Buildings are also able to take maximum advantage of the sun for space and water heating (Corbett,1981). By maintaining a north-south orientation, the structure can obtain the greatest solar intensities on the south side, while directing the most efficient insulation on the north side. Even simple things like vegetation, can improve efficiency. Coniferous trees on the north side insulate and shade year round, while deciduous trees on the south side can shade in the summer and allow exposure to the sun during the winter.

Possibilities for energy efficiencies within a building structure are limitless, but based on actions, there appears to be a lack of sufficient incentive for their widespread use. Voluntary

conservation could be acquired by financial encouragement. Changes in the rate structure could adjust to a "user-pays" system.

At the present, most energy efficiencies, such as R2000 or the fluorescent bulbs, are initially more expensive yet eventually cost-effective. These efficiencies are a form of investment, that generate returns by reducing ongoing costs. In contrast, not investing in efficiency is a form of consumption, and a wasteful one at that.

Unfortunately, initial costs to the builder are usually the determining factor. If financial incentives are not viable, mandatory regulations are another possibility. Building codes should be kept up-to-date with the latest conservation technologies. Reduction in energy demand and conservation ultimately lies with individual actions and attitudes, but there are limits to what individuals can do without collective action. Alterations will occur much quicker with some form of concrete motivation.

2. Encourage use of renewable energy sources. "Renewable energy sources-wind, water, biomass, and direct sunlight-hold substantial advantages over the alternatives. They add no heat to the global environment and produce no radioactive or weapons-grade materials" (Corbett,1981,66). Equally important is the fact that these sources of energy are renewable, unlike gas, oil and electricity which we depend almost completely upon.

Research surrounding renewable energy sources has vastly improved in recent years. Initial costs are more reasonable and many areas in the United States are already effectively capturing solar and wind power.

Solar or wind power seem to be the most appropriate renewable alternatives in this area as well. Solar panels in individual homes, offices and industries would assist in space heating. Solar water heaters are also a viable option. With the unpredictability of the weather, solar or wind power would still need connection to the regular utilities, but any reduction of energy use would be beneficial since heating of water in the home is the largest use of residential energy next to space heating (Burton,1984).

3. Aim towards local energy sources. There are many advantages for local production of energy. These include;

- reducing the equipment needed for transmission and conversion
- reducing energy lost in transmission and conversion
- increasing stability by using small independent units rather than interdependent systems susceptible to major failures
- localizing both the environmental impacts of energy production and the control over means of production-leading to wiser energy use (Corbett,1981).

Local sources also reduce and avoid the evils of monopoly, and highly centralized sources.

Small scale production systems based on solar or wind power could be set up to supply small communities or neighbourhoods. Individual conservation along with input from a community system would further reduce dependency on connections with regular utilities.

5.3 Water Efficiencies

Canada and Ontario are fortunate to be in close proximity to abundant water supplies. The Great Lakes contain almost 1/5 of the world's fresh water. This readily available water and its continual flow does not encourage water conservation. Like energy, our water consumption has increased dramatically over the years.

The implications of sustainable development also apply to water resources. Reduced demand and conservation need to be practised in order to ensure future generations a vital water source. Local governments, again, play a key role in water conservation strategies. Providing housing structures with the most up-to-date water efficient features, and encouraging water recycling where possible are some ways of attacking this problem. As with energy, a local water source would be the ideal.

1. **Ensure building structures utilize the most water efficient technologies.** There are a variety of water saving devices which can be incorporated into new structures. Some of the most popular fixtures and appliances are; shallow trap toilets, composting toilets, pressurized flush toilets, pressure-reducing shower valves, flow restrictor valves and several water efficient appliances. A more complete list of available local options is found in Table 2, and 3 in Guidelines to Encourage Water Conservation in New Structures (Howard-Ferreira and Robinson, 1980). The concept of providing incentives, like "user-pays" or marginal cost pricing, to encourage reduction is also necessary for water use.

2. **Encourage recycling of water where possible.** Water from showers and washing machines, called greywater, may be reused to irrigate lawns, flowers, trees and gardens. Installation of a second drain from the shower could feed directly into drip lines buried below the surface (Corbett, 1981).

Many technologies which reuse greywater are in experimental stages. There is also ongoing research examining the use of storm water runoff. New water conservation ideas should be encouraged in all residential, commercial and especially industrial sectors, when appropriate.

3. **Aim towards local water supply.** A local water supply has advantages analogous to a local energy supply. As well as reducing the equipment, costs and energy needed for long distance transport, a local supply stimulates small scale requirements, independent control, and conservation awareness.

Although a local water supply is sometimes impossible, due to location, it is an ideal to strive for. The possibilities should be considered prior to new development site approvals.

5.4 Waste Management

Garbage production has increased enormously over the years. As landfill sites reach capacity, garbage is transported across greater distances, and costs multiply. Yet, the farther away a landfill site is from the city, the less pressure there is on the city's dwellers to reduce their waste. When waste disposal is out of site, it also becomes out of mind (Fowler,1990).

Integrated waste management begins with the four R's; reduce, recycle, recover and reuse. The need for disposal should then be minimized, thus making the use of a landfill site or export a last resort. Incineration is not a sustainable option. The garbage stream contains many materials that are extremely hazardous when burned. A separation process will divert most of the wastestream, including materials with most of the potential heat content, away from disposal or incineration. Moreover, incineration is the most expensive disposal option (SWEAP News,1990). Concentration on the four R's is imperative. Although efforts have been made in some of these areas, there is opportunity for vast improvement.

1. **Explore options for source reduction.** Source reduction is the reduction of the amount of solid waste generated at the source. Product packaging and containers used for food and beverages, are examples of over-packaging which could be reduced. There are a number of feasible options available to local governments which would reduce these excessive materials:

- deposits which result in the return of the container
- bans on certain types of materials if there are no recycling markets
- limitations on the variety and sizes of containers which would result in less weight and increased ease for recycling (GRCDA Newsletter,1990).

Reducing potential wastes at their origin, is a fundamental priority of waste management.

2. **Encourage composting.** Composting is a form of recycling and reusing nutrients. Organic substances composed 57% of Canadian municipal waste in 1980 (OECD,1985). By composting such items as fallen leaves, grass clippings, kitchen scraps, fruit and vegetable

peels, egg shells and coffee grounds, individual garbage production could be reduced substantially. Finished compost can then be used to fertilize gardens, lawns and house plants. This natural form of enrichment is an excellent replacement for chemical fertilizers.

There are now a wide variety of methods which can be used to compost. These range from outdoor wooden containers to small plastic bins which are even suitable for use in apartments. Local governments should consider supplying residents with a composting bin along with their blue recycling box. If individuals do not want to set up their own composting operation, bins could be emptied at a local composting facility. With a proper container, organic substances need only to be emptied about once a week.

The general failure to return natural organic materials to the earth from which they came, represents a good example of our society's loss of natural wisdom. Recycling these materials is necessary for the sustainability of the ecological systems.

3. Expand recycling services. Opportunity for further expansion of recycling exists. Glass, metals and newspapers are collected in the blue box on a weekly basis. Fine paper, corrugated cardboard, various plastics and used motor oil could also be recycled in the "blue box" within the existing recycling program. Unfortunately, there is often a very small market for these recycled materials, however, the development of these markets is essential to sustainable development. Industries or plants which utilize and distribute recycled material are in great demand. Future local entrepreneurs and industries should consider this opportunity.

Another possible means of expanding recycling options is by incorporating a small scale recycling depot or exchange facility within each neighbourhood. This facility could gather materials which are recyclable but not collected on a door to door basis. Further distribution or small scale treatment could take place right on the premises.

A neighbourhood facility could perform a number of related functions. As well as recycling, a central composting facility could be located here. Exchange facilities would also compliment the service. Products such as margarine and yogurt containers, hangers, boxes, and clothing could be collected here. Often these types of items can be reused by individual people, or organizations like a daycare centre. The key to making a community facility function properly, is to keep it small, central to the neighbourhood, and under the control and operation of community members.

Another suggestion which could easily operate in Canadian municipalities is a European system called the "wet-dry" (or green-bin) system;

"In a wet-dry system, the householder, business, or industry separates their waste at source into two containers. The wet container contains organic material suitable for composting. The dry container contains everything else. Materials collected in the dry container are then sorted at a central facility to capture a wide variety of recyclable materials. A variation of the wet-dry system is a three bin system where wastes are separated at source into wet-organic, dry-recyclable, and dry-other" (Environmental Concerns for Canadian Municipalities, 1989,21).

The opportunities for a more thorough waste management system are endless. With awareness and participation, a suitable program could operate quite efficiently. The success of the existing blue-box program implies a willingness and concern of all citizens.

5.5 Agriculture/Food Supply

A reliable food supply is the most critical element of sustainability. Due to the pressures of population growth and urban sprawl, Southern Ontario and the Region of Halton have already developed much of their productive and once abundant agricultural land. It was shown in the previous section that Halton has lost 39,790 hectares (98,320 acres) of farm land since 1931. While not measured precisely, aerial photographs of the City of Burlington also show a substantial loss of prime land in a prime climate, due to urban development.

As well as a loss of farm land, there has also been a decrease in the number of people employed in agricultural pursuits. It can be argued that as farming practises become more technologically advanced and efficient, fewer people are required. This is true, but an agricultural system which employs only 3.5% of the Ontario labour force is highly vulnerable, and obviously reliant on outside supplies. Moreover, of utmost importance for sustainability, is the need for farmers and farm culture. If these become extinct, who knows how to farm? Reliance on outside and distant sources of food is the antithesis of sustainability.

As supply lines lengthen, the cost and time involved in transporting food increases. As a result, food prices become inflated and preservatives and chemicals are needed. In general, there is a loss of control over price, quality and quantity. Allowing this to happen is completely inconsistent with sustainability.

An ideal sustainable region would be completely self-sufficient in its food production. Although this ideal may be improbable in total, it is wise and not unrealistic to preserve and promote local supplies, as well as encourage individual or group production.

1. **Protect and preserve the remaining farmland.** Since so much of the prime agricultural land in this region has been lost, it is essential to secure what is remaining.

2. **Support local food sources.** There are a number of ways to promote locally grown and produced food. It is necessary to provide a location where consumers can purchase local food. Farmers could sell produce from their individual farms but the concentration of buyers is not advantageous in this arrangement. A local market, once or twice a week, would enable producers and consumers a specific time and place for trade. If the community members were aware of the benefits of supporting local farmers; freshness, value and economic support, a market could be quite effective. In many areas, such as Kitchener-Waterloo, a farmer's market is a thriving weekly event. Both producer and consumer benefit in this symbiotic relationship.

In grocery stores, where local produce is sold, labels or signs which advertise its local advantages could accommodate its display. Consumer awareness is an essential component.

Since local food is produced near-by, its cost should ideally be much less. Due to subsidies, varying wages, and quotas, this is not always the case. When and if possible, taxes and/or subsidies which ensure financial incentives for local food could be implemented.

3. **Encourage individual or neighbourhood food production.** Food production can take place on a number of levels. As well as local farms, neighbourhood communities, groups of households and individual households are all able to contribute to food production.

Gardens, either individually or collectively owned, are able to produce a large percentage of a household's food requirements. Neighbours could plan to grown certain vegetables and then by sharing and exchange, their range of yield is extended.

Gardens are possible in places other than private yards. Rooftops can be adjusted to incorporate gardens, and common space within a community can also be used for food production. The design of new communities could involve increasing resident structure density (e.g. village or cluster), drastically reducing road and driveway coverage, and using the saved land for community based gardens and food production. Local ownership could govern operation and distribution of the produce, and also allows opportunity for local employment. This is sustainable development; it integrates environment and economy.

Another related but indirect method of gardening is called 'edible landscaping'. "Vegetable gardens, herbs, fruit and nut trees, and grapevines can be integrated into private yards and

small common areas to serve many of the same purposes as purely ornamental landscaping" (Corbett,1981,52). Even the least interested households can benefit from this low maintenance form of agriculture.

Greenhouses or hothouses can be incorporated into community design in the same way as gardens. Whether individually or communally operated, these allow food production to occur even during the winter months. Local agriculture, even on the smallest scale, can save on grocery bills and transportation costs. It also stimulates community interaction and support, and reconnects the link between the source and the supply.

5.6 Options to Automobile Travel

The automobile has become an central focus of lifestyles and land use decisions since its introduction in 1902. Vast amounts of land are necessary to accommodate the automobile. An average interchange takes up 80 acres (Berton,1990). Highways, roads, driveways and parking lots are all paved and regularly maintained at enormous costs. The car is a major source of air and noise pollution and is reliant on non-renewable resources; gasoline and oil. There are also traffic jams, accidents, taxes and insurance fees to add to the stress.

This central focus on cars, and therefore roads, is most vividly shown by current efforts of the City and the Region of Halton in urging the Province to complete the Highway 403 extension. This highway route cuts diagonally through several communities in the City of Burlington. If completed, this road will be a source of noise and air pollution to about 265 single-family and 785 higher density dwellings on properties directly adjoining the proposed route (Muir,1990). This is a very conservative estimate of social impacts since only directly adjoining properties are included in the count. The actual number of people affected will be much higher since noise and pollution are not confined to only the adjacent lots. Sound barriers do not absorb the noise but only redirect it somewhere else. The value of these properties will surely be depressed.

The 8-10 year or longer construction period undercuts the road's value as congestion relief. This long time period for changing priorities away from new roads is inconsistent with the time period within which action toward sustainability must be undertaken. Movement to sustainable land-use and development cannot wait 10 years. As a sustainable alternative, the right-of-way for the proposed Highway 403, could remain in its natural state as a linear park for walking, biking, wildlife habitat and education.

Despite these obvious drawbacks, new neighbourhoods are still continually designed with the car as top priority. Most single family dwellings in Headon Forest have an attached double car

garage. Road coverage has increased, even though a winding residential pattern still exists. Public transit is not economically feasible in such low density residential areas, and the separation of schools, commercial facilities and industries contributes further to this dependency on the automobile.

In order to begin reversing the trends, options to automobile travel need to be available. Simple alternatives include centrally located facilities, mixed-land use, local employment and pedestrian and cyclist paths. This need to drastically reduce the car-centredness of our social design is one of the most important philosophical shifts noted in the general principles of sustainability.

1. **Provide centrally located services.** If services are located in close proximity to residents, the option to walk or ride a bike is then viable. Schools, small grocery stores, banks, a composting and recycling co-op, and other essential facilities could exist productively within each community.

2. **Allow and encourage multiple land use.** The separation of residential, commercial and industrial areas has contributed to urban sprawl and the necessity of the automobile. Multiple land-use suggests that offices, shops, industry and residential areas can be combined and intermingled. This contributes to closely located services, further reduces the need for an automobile and adds character to a community. This idea is a central example of the sustainability concept of integration; it acts to integrate, not separate.

3. **Provide opportunity for local employment.** Multiple land use also contributes to increased opportunities for local employment. Locating small scale businesses, and industries as well as the essential, daily facilities within a community offers numerous advantages. The separation of work and home is eliminated. Employees are less dependant on an automobile to get to work. Reducing the time necessary to commute also allows more free time for family and community interaction.

Local employment integrates working and living areas and thus creates greater involvement in, and concern for the community. The key to successful local employment is to match the employment opportunities to the needs and the skills of the community members.

4. **Give first priority to pedestrians and cyclists.** When designing the layout of a community, top priority should be given to pedestrians and cyclists. Pathways through parks and common areas provides recreation and can also function as a link between residents, schools and services. Pathways through natural areas provide access yet also offer protection by limiting the area of heavy use.

The space designated specifically for roads can incorporate various modes of transportation. Sidewalks and bike lanes should accompany every roadway. Pedestrian crossovers, at necessary junctions promote and ensure safety.

Areas without automobile access are also important. Pedestrian streets offer numerous advantages. Noise and pollution are reduced, opportunity for passive recreation exists, and a human scale, community environment is created. Participants of a Healthy City seminar envisioned a central pedestrian core as a major focus of their "healthy city".

4. Discourage use of cars. Discouraging the use of the automobile provides further motivation for alternative travel. There are already many environmental and financial reasons for not operating or owning a car. Even though purchase prices, taxes, insurance, gasoline, and maintenance costs are exorbitant, cars are still the main transportation mode. Automobile use could be further discouraged by adopting the following criteria when considering any development proposal;

- designs which minimize roads
- no provisions for parking
- acceptance, and encouragement of, densities which would result in congestion if cars were the main means of transportation
- favourable considerations given to proposals which narrow a street to fewer than the existing number of lanes, as long as sidewalk widths are maintained (Fowler, 1989).

It is also essential to not succumb, as is now the case, to the demands for more roads (e.g. Highways 403).

5.7 Alternate Housing and Lot Arrangements

The most recent residential neighbourhoods, like Headon Forest, have extrapolated the single-family dwelling with its individual lot, so far along the scale, that it is no longer appropriate. The basic principles of physical structures indicate that at certain scales of smallness (and largeness), the organizational form of the units that make up the structures must be changed.

Land is scarce and expensive and now makes up about 50% or more of the cost of the average subdivision. This has risen substantially over the past 15 years. With these inflated prices, it is advantageous for developers to decrease the size of individual lots, and build the maximum number of homes in a given area. The average size of the single family home in these residential areas continues to increase, even though lots are smaller. Since community facilities, common space, and natural areas are of negative economic value to the developer, they are

kept to a minimum. The overall result is a community which lacks diversity, ecological balance, and social stimulus. There is also a tremendous waste of land.

For development to become sustainable, alternative housing and lot arrangements must be implemented. Mixed land use, and an assortment of housing, including clustered or village designs, would increase the diversity of the community. Private and common areas which integrate the natural and developed areas are also needed and are possible. Recall again that sustainability integrates environment and economy. Low density sprawl could be replaced by medium density with much more open space for a variety of land forms and uses. As noted above, designs that did not cater to cars, would add substantially to the balance of increased open space and density.

1. **Allow and encourage mixed housing functions.** Most of the homes in Headon Forest are single-family units. These homogenous homes could be replaced by a variety of styles, sizes and functions. Provisions for couples, seniors, and singles mixed within single-family homes would create a greater diversity, and suit the needs of a greater range of people.

Diversity is an integral aspect of sustainability. A basic biological principle states that "a system formed by more elements with greater diversity is less subject to fluctuations" (Corbett, 1981, 13). This concept also applies to human communities. A range of members with varying abilities, experiences and economic status can interact and benefit from one another. An assortment of housing which caters to a range of lifestyles would entice this diversity.

2. **Approve only medium densities with lots of open space.** A medium density consists of less than 30 units per acre, (single-family homes= 6-10 units/acre, high rise apartments= 50-100 units/acre), (Ramsay, 1990). There are several housing styles being utilized which fall into a medium density category; townhouses, triplexes, low-rise apartments and quads. By utilizing a greater density, less land can accommodate the same number of people as low density single-family homes and individual lots. This leaves more open space for recreation, common area and natural cover. This type of approach is referred to as clustered development.

"Compared to individual housing clustered developments greatly reduce negative environmental impacts both during and after construction" (Nebel, 1987, 621). The advantages are numerous;

- clustered units are more energy efficient
- they can be efficiently serviced by public transit because each cluster makes a convenient stop
- services such as waste collection are similarly more efficient

- provisions of water, sewer and other utilities are more efficient
- greater open space preserves water in terms of quality and quantity of runoff
- greater open space can provide for recreation, gardens, natural cover
- fewer roads are necessary
- more affordable housing is provided (Nebel,1987).

The design of such arrangements could become very creative and unique. Various land uses and mixed housing could be incorporated. Some private lots are also possible, but emphasis would be on common open space.

5.8 Recreation of Community Cohesion

The community atmosphere has been ignored in many of the new residential developments. Most of the houses in Headon Forest are single-family units with two car garages and a small, fenced-in back yard. Facilities are minimal. Large strip malls are the only available local shopping and there are no schools. The overall community lacks diversity and offers limited opportunity for social interaction.

The communities and residents adjoining the proposed 403 extension will be further fragmented and alienated if the highway is constructed. The replacement of existing woodlands, wildlife, and open space by a major highway, with its attendant noise, pollution and pavement, further diminishes the existing limited opportunities for social interaction, particularly among young children, with each other, and with the natural environment.

A sustainable community needs to balance and integrate economics with both environmental and social concerns. Many of the principles previously mentioned would benefit community cohesion. Multiple land use and mixed housing create a diversity and opportunity for local employment. Emphasis on pedestrians and cyclists rather than the automobile keep the neighbourhood free of unnecessary pollution, noise and pavement. It also offers social and recreational opportunities. Clustered developments ensure appropriate open and natural space. Several other aspects would improve the community atmosphere.

1. **Keep community within optimum size.** In the past, there has been a variety of research done on the most productive size of a community. An ideal "neighbourhood unit" was discovered to range between 3000 and 9000 inhabitants, with an optimum size at 5000 (Sale,1980). Clarence Perry's theory states that a neighbourhood of about 5000 is "small enough so that everything important--schools, playgrounds, shops, public buildings--is within easy walking distance, and large enough to support an elementary school and a variety of local stores and services" (Sale,1980,186).

2. Ensure all daily needs are provided within the community. It is essential that there is provision for all daily needs within walking distance of community members. According to Perry's theory, a community of 5000 at a density of 15-20 people per acre is able to productively support these basic facilities. A medium density with less than 30 units per acre would be appropriate.

3. Members must be involved in decision-making processes. Two essential ingredients of community are a sense of belonging and a sense of control (Jones, 1990). In order for community facilities to operate effectively, it is important for members to be part of the decision-making process. Communal ownership of common areas, gardens, community centres or co-op facilities would ensure participation. The suitable employment opportunities could also be affected by community decisions.

6. CONCLUSIONS

The present land use patterns reflect the consumptive value system of the industrialized world. Resource use, garbage production and urban sprawl have all increased enormously. Developments continue to build and pave over prime agricultural land. New subdivisions with larger dwellings, on increasingly smaller lots, lack diversity, social stimulus and harmony with the natural environment.

Development, that is sustainable, needs to integrate environment and economics-the natural with the man-made. Alternatives which encourage decentralization, the use of local sources, small scale development, multiple land use, medium densities and conservation of natural areas, are a step in this direction.

Actions which move towards sustainability must begin immediately. This next decade-the turnaround decade-will determine whether we are capable of reversing humanity's constant exploitation of the endangered ecological systems that support all human and biological life.

7. APPENDICES

APPENDIX 1- Regulations for Single-family Residences.

ZONE	LOT AREA (sq. m.)	LOT WIDTH (lineal m.)			YARDS (lineal m.)				FLOOR AREA (sq. m.)
	Lot Area	Width of Smallest Lot	Width of Average Lot	Width of Corner Lot	Front Yard	Side Yard	Rear Yard	Corner Lot	
	Col. 1	2	3	4	5	6	7	8	9
R1	929	24.3			9.1	a	9.1	f	
R1.1	743.2	18.2	21.3	21.3	9.1	b	9.1	k	
R1.2	696.7	21.3			9.1	b	9.1	g	
R1.3	1858	30			9.1	a	9.1	f	1 sty 130 1 1/2 sty 139.3 2 sty 167.7 Split level 134.7
R1.4	680	18	21	21	7.6	b	9.1	e	
R2	743.2	21.3			7.6	a	9.1	e	
R2.1	743.2	21.3			7.6	a	9.1	e	
R2.2	724.6	18.2			7.6	b	9.1	e	
R2.3	696.7	18.2			6	a	7.6	h	
R2.4	696.7	17.9			6	b	7.6	i	1 sty 111.4
R2.5	659.6	16.4			7.6	b	9.1	e	1 1/2 sty 125.4
R2.6	631.7	18.2			7.6	b	9.1	e	2 sty 139.3
R2.7	603.8	18.2			7.6	b	9.1	e	Split level 116.1
R2.8	603.8	18.2			6	b	9.1	d	
R2.9	557.4	15.2			7.6	b	9.1	e	
R2.10	603.8	18.2	19.8	19.8	7.6	b	9.1	e	
R2.11	510.9	15.2	16.7	18.2	6	b	9.1	d	
R2.12	557.4	16.7	18.2		7.6	b	9.1	e	
R2.13	510.9	16.7	18.2		6	b	9.1	e	
R3	668.8	18.2			6	a	9.1	d	
R3.1	510.9	15.2	16.7		6	b	9.1	d	2 Bedroom
R3.2	534.1	15.2			6	b	9.1	d	1 sty 88.2
R3.3	464.5	15.2	16.7	18.2	6	b	9.1	d	1 1/2 sty 97.5
R3.4	510.9	15.2	16.7	18.2	6	b	9.1	d	2 sty 102.1
R3.5	490.5	13.4			6	c	9.1	d	Split level 102.1
R3.6	464.5	13.5	15.2	18.2	6	b	9.1	d	3 Bedroom
R3.7	464.5	13.5	15.2	18.2	6	b	9.1	d	1 sty 97.5
R3.8	418	13.5	15.2	18.2	6	b	9.1	d	1 1/2 sty 111.4
R3.9	464.5	m			4.5	b	7.6	d	2 sty 116.1
R3.10	464.5	15.2			6	b	7.6	j	Split level 102.1
R3.11	696.7	16.7			6	b	7.6	h	
R4	445.9	12.1			6	a	7.6	d	

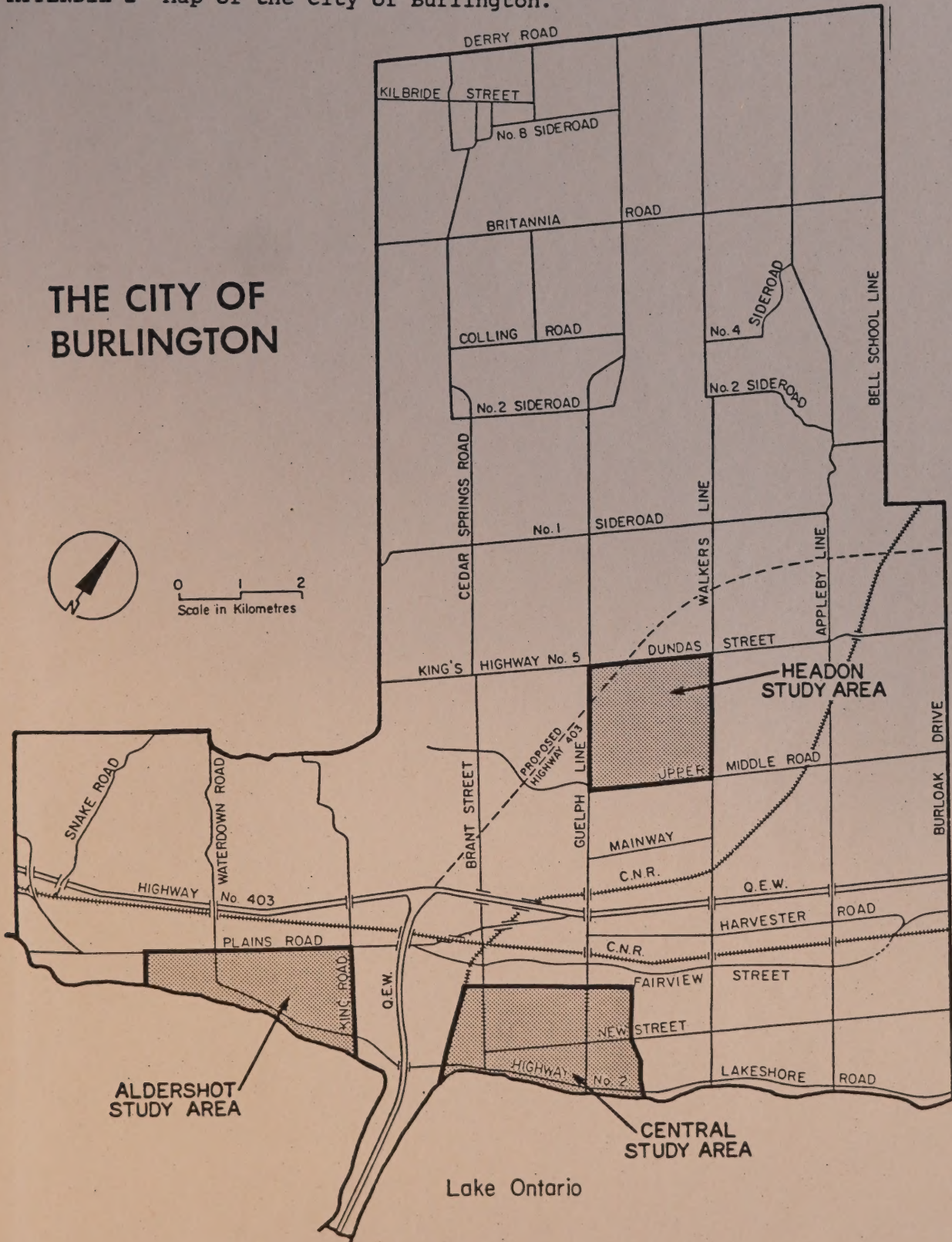
(Amended by By-laws 4000-399 and 4000-536)

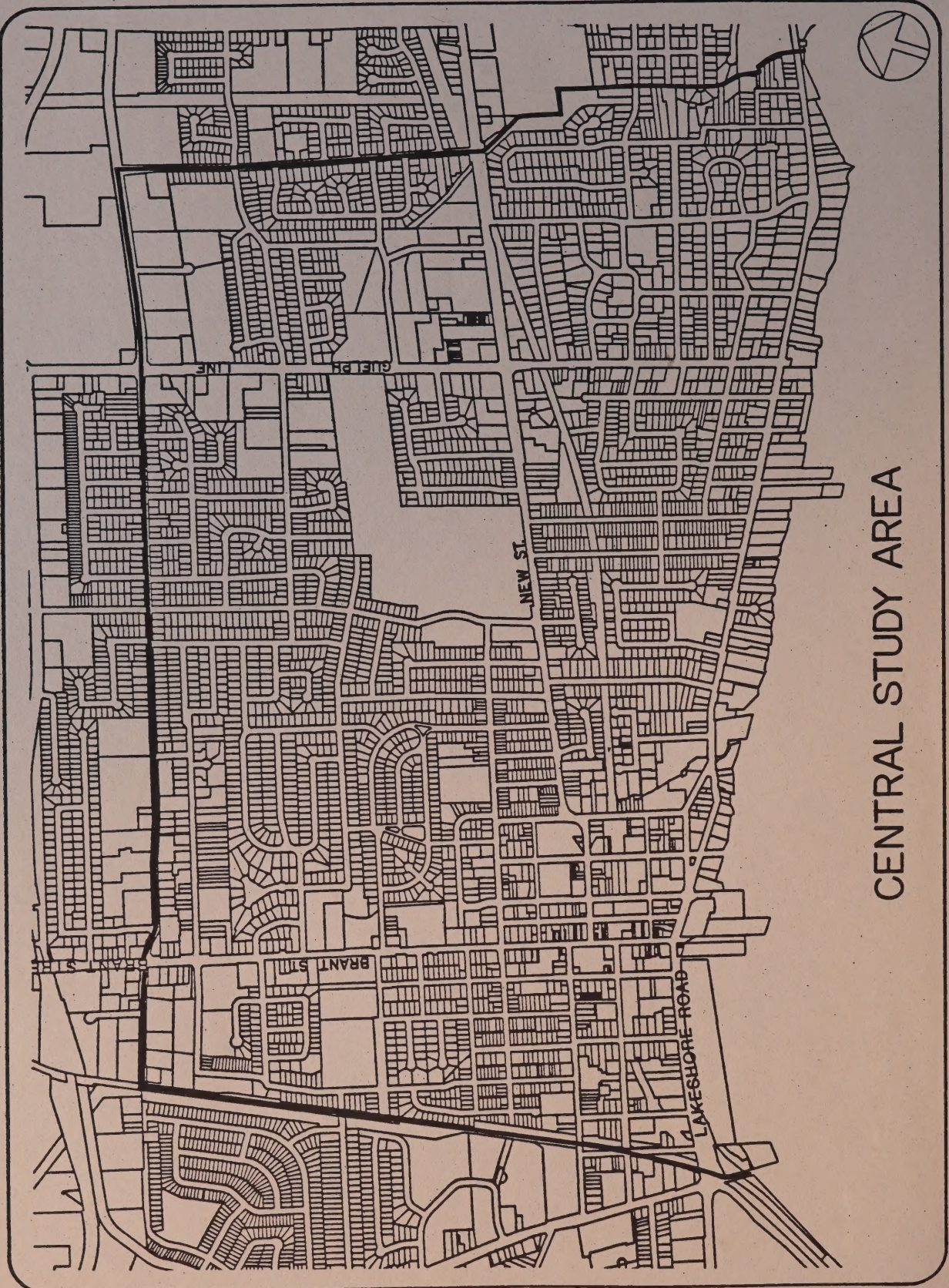
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Source: Corporation of the City of Burlington, Zoning Bi-laws
#4000-3, as amended, 1989.

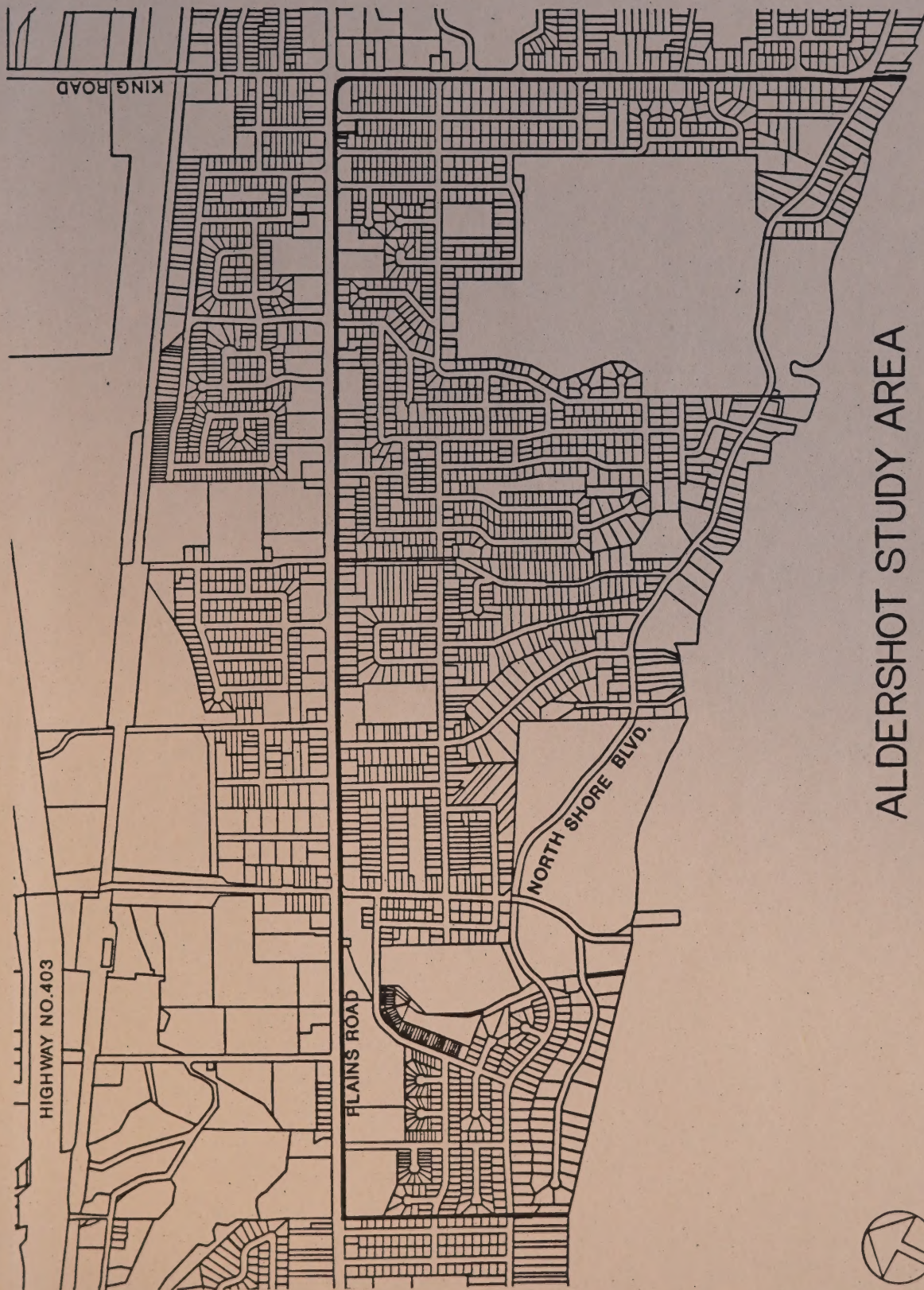
THE CITY OF BURLINGTON





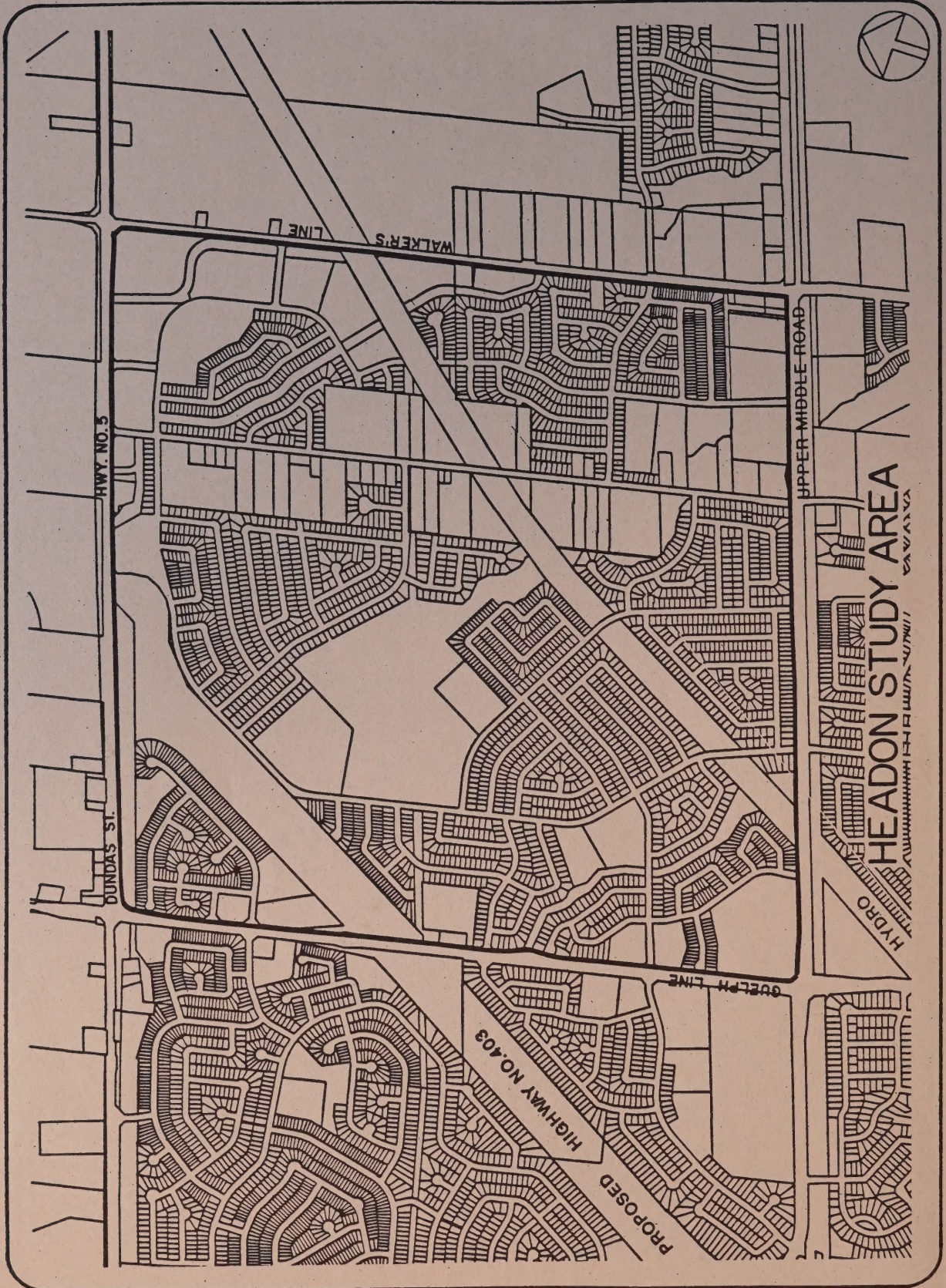
CENTRAL STUDY AREA

Source: Corporation of the City of Burlington, Planning Department.



ALDERSHOT STUDY AREA

Source: Corporation of the City of Burlington, Planning Department.



Source: Corporation of the City of Burlington, Planning Department.

8. REFERENCES

- Baumol, W.J., and W.E. Oates. 1979. Economics, Environmental Policy and the Quality of Life. New Jersey:Prentice-Hall, Inc.
- Berton, P. 1990. "Wheels-The Car as a Cultural Driving Force". Canadian Geographic, (Dec.89-Jan.90), 44-53.
- Burton, D.T. 1984. Water Conservation: Practices and Possibilities. Department of the Environment, Inland Waters/Lands Directorate, Water Planning and Management Branch, Ontario Region.
- Canadian Environmental Advisory Council. 1989, Land Use Planning and Sustainable Development in Canada, by Nigel Richardson, Canada:Minister of Supply and Services.
- Canadian Mortgage and Housing Corporation. 1955-1986. Canadian Housing Statistics, Statistical Services Division, Canada:Minister of Supply and Services.
- Corbett, M.N. 1981. A Better Place to Live. Pennsylvania:Rodale Press.
- Corporation of the City of Burlington. 1958. City of Burlington, Annual Budget. Department of Finance, Burlington.
- . 1964. City of Burlington, Annual Budget. Department of Finance, Burlington.
- . 1990. "Background Report Official Plan Review Working Group", Planning Department, Burlington.
- . 1990. City of Burlington Official Plan Amendment No. 49, Office Consolidation, Burlington.
- . 1990. City of Burlington, Annual Budget. Department of Finance, Burlington.
- . Municipal Address Maps #2,3,4A,5 and 11. Planning Department, Burlington.
- . 1990. Municipal Property Assessment. Planning Department, Burlington.
- Donaldson, C., 1989. Building the Sustaining Region. Planning and Development Department, Regional Planning Branch, Regional Municipality of Hamilton-Wentworth.

- . 1990. Diverse and Productive Greenspace for Sustainable Communities. Paper outline-"City Form and Natural Processes".
- El-Hinnawi and Hashmi. 1987. The State of the Environment. United Nations Environment Program, Butterworths, London.
- Federation of Canadian Municipalities. 1989. Environmental Concerns for Canadian Municipalities, prepared by Wallace Associates, Cameron, Ontario.
- Fowler, E.P. 1989. Planning the Ecologically Sensible City. Department of Political Science, Glendon College, Toronto: York University.
- GRCD A Newsletter-The Association of Solid Waste Management Professionals. 1990. Larry Hickman ed., Feb., vol.12, no.2., Maryland.
- Howard-Ferrierra, S., and J.E. Robinson. 1980. Guidelines to Encourage Water Conservation in New Structures. Municipal Working Group on Water Conservation, Waterloo.
- J.M. Edwards Associates Inc. 1989. "Burlington Housing Statistics-Average Sale Price".
- Jones, G. 1990. Personal Communication.
- Kalinauskas, R. and R. Rivers. 1989. Water Demand Management-A Soft Remedial Action For the Hamilton Harbour Remedial Action Plan. Department of the Environment, Inland Waters/Lands Directorate, Water Planning and Management Branch, Ontario Region.
- Moore, T.F. 1920. "Prevailing Methods of Garbage Collection and Disposal in American Cities", The American City. May, 529-539.
- Muir, T. 1989. Sustainable Development. Unpublished manuscript. Presented at 1989 International Association for Great Lakes Research Conference. Environment Canada, Burlington, Ontario.
- Muir, T. 1990. Personal Communication.
- Nebel, B.J. 1987. Environmental Science-The Way the World Works. New Jersey:Prentice Hall, Inc.
- Ontario Hydro. 1989. Providing the Balance of Power-Overview.
- . How You Use Energy Wisely-Energy Tips from the People of Ontario.

- . Load Forecast Report No.871214, Ontario Primary Demands-Total Systems-Table C, from Load Forecast No.881212.
- Ontario Motor Vehicle Licensing Office. 1990. Personal Communication.
- Ontario Roundtable. 1989. Comments by Rick Findlay at a Networking Workshop on Environment-Economy Relations and Sustainable Development, Burlington.
- . 1990. Product Profile; Compact Fluorescent Lamps, Toronto.
- Organisation for Economic Co-operation and Development (OECD). 1985. OECD Environmental Data Compendium 1985. Paris:OECD Publications.
- Ramsay, J.A. 1990. Personal Communication.
- Regional Municipality of Halton. "Panel Presentation and Public Forum", re: the Garbage Crisis in the Greater Toronto Area.
- Sale, K. 1980. Human Scale. New York:Coward, McCann & Geoghegan.
- Statistics Canada. 1931, 1941, 1951, 1956, 1961, 1966, 1971, 1976, 1981, 1986. Census of Canada. Canada:Minister of Supply and Services.
- . 1931-1986. Canadian Economic Observer. Canada:Minister of Supply and Services.
- . 1983. Historical Statistics of Canada, 2nd ed., F.H. Leary ed., Canada:Minister of Supply and Services.
- . 1988. Canadian Economic Observer-Historical Supplement, Canada:Minister of Supply and Services.
- Suzuki, D. 1990. "Our Planet: Energy-Use it, not abuse it", The Saturday Star, .
- SWEAP News (Solid Waste Environmental Assessment Plan). 1990. Spring, No.19, Toronto.
- Theisz, R. 1989. Personal Communication.
- Van der Ryan, S., and P. Calthorpe. 1986. Sustainable Communities. San Francisco:Sierra Club Books.
- World Commission on Environment and Development. 1987. Our Common Future. Great Britain:Oxford University Press.

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